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VALLEY CITY, OHIO

**CONCRETE VERTICAL
TUBE SEPARATOR
(CVTS)**

8/99
AFL
TOM BENAMIN
(561) 844-5200
COALESCEORS
1'x1'x4' ARE 220
#55/SQ FT OUR
MAY BE 5' LONG

RAY LOPEZ 12/12/99

8'-1x1x5
2'-1x1x4
55#/cu ft
x 48 cu ft
2640 70

JOB NAME: CANTON DROP FORGE

JOB NUMBER: 78100

INSTALLATION DATE: 1-17-96

**INSTALLATION, OPERATION
AND
MAINTENANCE MANUAL**

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Design Flow 125 GPM

Maximum Operating Capacity 698 Gallons

Oil Storage Capacity 1728 Gallons

Materials All pipes and fittings shall be schedule 40 PVC. All tank flanged connections are 150# flat face flanges. Pump discharge piping, sch40, galvanized pipe.

Each unit shall conform to the following specifications:

Junction Box Nema 4X

Level Switches 5

Inlet Chamber 1'-0" long x 2'-0" wide, complete with inlet baffle and diffuser.

Coalescing/Separation Chamber 6'-6" long x 2'-0" wide, packed with vertically positioned matrix of perforated polypropylene oleophilic tubes, complete with sludge collection zone below tubes.

Oil Collection 6" Rotary Pipe Skimmer, manually operated complete with oil retention baffle.

Oil Sheen Baffle 1'-0" high x 2'-0" long, located before effluent weir wall.

Effluent Chamber 3'-6" long x 2'-0" wide chamber, complete with weir wall, adjustable weir plate arrangement which allows effluent discharge from the bottom of the chamber only.

Lifting Eyes See Installation Instructions for equipment and preparation required.

Access Manways

Dosing Chamber One (1) 36" x 48" aluminum hatch over dosing pumps

Separator One (1) 12" dia casting over sludge pipe.

Oil Chamber One (1) 18" dia casting

Manway Steps Four (4)

Approximate weight of
removable cover

30 lbs.

Oil Chamber Level Switch

One (1) Float Switch as manufactured by B & O 1900.

Dosing Chamber Level Switches

Four (4) Float switches as manufactured by B & O 1900.

All piping, electrical components, and appurtenances not specifically listed in the above specifications -
NOT BY MACK INDUSTRIES

Equipment Specifications

Application Removal of free oil and settleable solids from oil/water mixture.

Drawing Number OILSEP-125

Number of Units One (1)

Outside Unit Dimensions 13'-0"L x 7'-0"W x 14'-0"H

Inside Unit Size 12'-0"L x 6'-0"W x 13'-0"H

Storage Inside Unit Size 12'-0"L x 3'-6"W x 5'-10"H

Construction

Concrete Strength 5000 PSI Minimum

Concrete Type III

Reinforcing Bar Grade 60, ASTM A-615

Joints Two (2) rows of con seal cs-440 oil resistant are to be used on all joints. All joints are to be grouted with non-shrink grout on the inside and the outside of the structure.

Design Parameters

Uplift The structure is designed for uplift, assuming that water table is at the top of structure.

Lateral Earth Pressure Assumptions

Saturated Unit Weight 115 pcf

Angle of Internal Friction 30

Equivalent Fluid Pressure 65 pcf

Vehicle Loading HS-20

Surcharge 80 psf Live Load Surcharge applicable depth of 8'.

Impact 30%

Installation Flush with grade

GENERAL ELECTRICAL SPECIFICATIONS

Type of Equipment	(2) Submersible Pumps (Barnes 3SE)
Type of Application	Effluent Pumping
MACK Drawing Number	OILSEP #78000
Sequence of Operation	Duplex - Auto alternation - Float switch controlled.

CONTRACTOR - PLEASE READ THIS

INSTRUCTION CAREFULLY

Mack Industries provides you with several valuable aids, and the few minutes you spend reading this instruction will save you hours later. The purpose of this instruction is to acquaint you with the equipment erecting knowledge which you now have at your fingertips.

THE INFORMATION CONTAINED IN THESE INSTRUCTIONS ARE BASED ON YEARS OF EXPERIENCE WITH THE ERECTION OF OUR EQUIPMENT, BUT ARE INTENDED AS A GUIDE ONLY. THE EQUIPMENT WHICH YOU HAVE AVAILABLE TO YOU MAY DICTATE OTHER, MORE CONVENIENT, PROCEDURES BUT THE FINAL RESPONSIBILITY FOR SELECTION OF ERECTION PROCEDURES OR TOOLS IS NOT BORNE BY MACK INDUSTRIES.

Installation Manual

This manual contains the heart of the information necessary to erect the equipment. It is structured as follows:

1. Title Page and General Instructions;
2. Table of Contents - listing of descriptions and reference numbers for all drawings
3. Specific Contract Information.

The complete section of information provided for each contract includes

1. Contract Equipment Specification - a written description of the equipment.
2. Installation Instructions - a general erection instruction for the equipment provided.

3. Assembly Drawings - showing the unit and its various components.
4. Operation and Maintenance Instructions.

General Instructions

RECEIVING MATERIAL

Upon receipt of a shipment, you should immediately check goods received. If you find that certain items are missing, make a note of this on the shipping papers to protect your interest. Also, IMMEDIATELY notify Mack Industries of this shortage.

All material has been thoroughly checked and inspected before shipment. If the equipment is received in bad condition or if the packages are broken, make a bad order notation on the shipping papers to this effect. THIS PROTECTS YOU since it will enable you to place the proper claims against the freight company. Notify proper authorities IMMEDIATELY if any parts are found broken or damaged during shipment.

Please handle the equipment properly when unloading and erecting. All cartons, electrical equipment, and gear drives, shipped separately or mounted on tank, should be stored under cover and protected from moisture, grit, and mud. Mack Industries will not be responsible for material deterioration due to improper handling, exposure, or inadequate protection during storage.

PROCEDURE FOR ORDERING SPARE OR REPAIR PARTS

1. Identify your equipment using the Mack Industries contract number shown on equipment specification sheets.
2. - Identify the part by name and give the number of the drawing on which this part or assembly appears. If it is a part for a motor, pump, electrical control or any part not manufactured by Mack Industries, the information will be found in the manufacturer's reference data included in this brochure, or on the manufacturer's nameplate.
3. Show the part number. (Information can be gained in the same manner.)
4. Show the size, and include all pertinent dimensions (such as diameter, length, thickness, bore, pitch, etc.) whenever possible.

5. If parts being ordered are electrical in nature, give all pertinent data; voltage, amperage, wattage, cycle, speed power factor or other information given on a nameplate or in the brochure.
6. Submit your written purchase order or request for quotation, both signing and printing your full name so that we will know whom to contact should further clarification of the order be necessary. **ALL VERBAL ORDERS MUST BE CONFIRMED IN WRITING.**
7. Give return address, and shipping address.
8. Give preferred method of shipping: Parcel post, truck freight, rail freight, air express, etc.
9. Show quantity desired.
10. Give directions on where to send invoice.
11. **ALL SPARE OR REPAIR PART ORDERS ARE SUBJECT TO A \$100.00 MINIMUM ORDER CHARGE.**

BACKCHARGES

MACK INDUSTRIES will not accept any charge for modification, servicing, adjustment or for any other item without written authority in the form of a PURCHASE ORDER issued from the home office at Valley City, Ohio IN ADVANCE of doing the work. This authority will only be given when satisfactory proof is submitted and the authority will only then be issued providing the price is agreed upon and the authority is given as outlined above BY OUR TECHNICAL SERVICE MANAGER.

ANY BACKCHARGE SUBMITTED CONTRARY TO THIS AGREEMENT WILL BE REJECTED IN TOTAL WITHOUT CONSIDERATION.

FURTHER ASSISTANCE

The erection aids material provided by Mack Industries should enable you to install, operate, and maintain the equipment. This instruction is provided to help you to help yourself, and therefore, to save you time and expense. If a problem is encountered in installing or operating the equipment which cannot be solved by referring to the available material, please feel free to contact us. Address your inquiry to our Technical Service Department, Mack Industries 201 Columbia Road, Valley City, Ohio 44280 or call us at 1-800-482-3111 or 1-216-483-3111.

WARNING

On desalting applications, do not allow emulsion layer or interface emulsion layer to enter oil / water separator stream. Either bypass the stream, or segregate stream interface. Emulsion layer will cause plugging of coalescing tubes and delta packs.

If an accidental spill occurs, remove coalescing tubes and delta packs and clean immediately.

De-emulsifier similar to ARCO 3037 may be used in cleaning operation.

Plastic Piping Handling, Storage, & Assembly

HANDLING AND STORING PLASTIC PIPE

Plastic pipe does not require "kid glove" treatment; however normal precautions should be taken to prevent excessive mechanical abuse. When unloading pipe from a truck for example, it is unwise to drag a length off the tailgate and allow the free end to crash to the ground. Remember too, that scratches and gouges on the pipe surface can lead to reduced pressure-carrying capacity. Standard pipe wrenches should not be used for making up threaded connections since they can deform or scar the pipe; use strap wrenches instead. When using a pipe vise or chuck, wrap jaws with emery cloth or soft metal.

Pipe should be stored on racks that afford continuous support and prevent sagging or draping of longer lengths. Burrs and sharp edges of metal racks should be avoided. Plastic fittings and flanges should be stored in separate bins or boxes and never mixed with metal piping components. The storage area should be clean and have adequate ventilation. Plastic pipe should not be stored or installed near a steam line or other source of heat that could overheat the pipe.

CUTTING PLASTIC PIPE

Plastic pipe can be cut easily with a power or hand hacksaw, circular or band saw. For best results, use fine-tooth blades with relatively little set. A circumferential speed of about 6,000 ft/min is suitable for circular saws; band saw speed should be approximately 3,000 ft/min. Carbide-tipped blades are preferable when large quantities of pipe are to be cut. Pipe and tube cutters are not recommended since they might cause excessive heat and pressure that can result in cracked or irregular ends. To ensure square-end cuts, a miter box, hold-down or jig should be used. All burrs should be removed with a fine-tooth file, deburring tool or sharp knife. Chips, burrs, filings, etc., should be removed from the pipe I.D. before installation.

BENDING PLASTIC PIPE

Bending leaves residual stresses in plastic pipe and consequently, use of bends is not recommended, particularly when the line is to operate at or near maximum rated pressures and

temperatures. Factory made fittings and straight lengths of pipe invariably give better performance. When field bending is necessary to meet special conditions or to provide for expansion and contraction of the pipe, the following technique should produce good results:

1. Seal both ends of the pipe length with plumber's test plugs and introduce sufficient air pressure to maintain ovalness of the pipe during bending. The same purpose can be achieved by filling the pipe with pre-heated sand.
2. Heat the pipe uniformly by immersing it in hot oil or water, or by rotating it in front of a hot-air gun. An open flame should not be used.
3. When the pipe becomes soft and pliable, it should be placed in a wooden forming jig or form, and the bend should be made as quickly as possible to prevent weakening or deforming the pipe. The minimum radius to which a bend should be made is 5 to 6 diameters, but the initial forming bend should be slightly greater to allow for spring-back.
4. The bend should be kept in the forming jig until the pipe cools and becomes rigid; then it should be cooled quickly by immersion in water. Air pressure should not be relieved or sand removed until after final cooling.

(Thermoset plastics such as glass-reinforced epoxy cannot be field bent by heating, of course.)

SOLVENT WELDING PLASTIC PIPING

The preferred method for joining rigid thermoplastics such as PVC and PVDC, solvent welding provides stronger and tighter joints than threading. Here are tips that should be useful.

1. Use the proper solvent cement: PVC cement with PVC pipe and PVDC cement with PVDC pipe.
2. When solvent welding PVC pipe, apply PVC cement liberally to the pipe O.D. and to the fitting I.D.
3. Leave a fillet bead between pipe and fitting when solvent welding PVC and PVDC piping, but remove excess cement from ABS and CAB.
4. Use a natural (hog) bristle brush for applying solvent cement; nylon and other synthetic materials are attacked by solvents in the cements.
5. Use a 1/2" wide brush for pipe 1/2" through 1"; a 1" brush for 1 1/4" through 2" pipe; and a 2" brush for pipe 3" and larger.
6. An ordinary oil can is an excellent container for acetone or cleaner. Excessive evaporation is prevented and the solvent is always handy.

7. Never allow water to come into contact with solvent cement. Wrap a handkerchief around your forehead in hot weather to keep perspiration from dripping into the cement. When not using cement keep covered.
8. Allow solvent cement to cure 5 to 15 minutes before handling and wait 24 hours before introducing full line pressure in a solvent cemented piping system.
9. At end of day, place brush in solvent and cover cement tightly. When re-using brush, shake excess solvent out before dipping it into cement.

SOLVENT CEMENT REQUIREMENTS

NOMINAL SIZE OF PIPE	AVG. NUMBER OF JOINTS PER QT.		NOMINAL SIZE OF PIPE	AVG. NUMBER OF JOINTS PER QT.
1/2"	700		2"	90
3/4"	400		3"	70
1"	300		4"	50
1 1/4"	220		6"	32
1 1/2"	160		8"	20

THREADED JOINTS

Take-down piping systems and temporary lines usually are installed with threaded connections. Threading reduces the effective wall thickness of the pipe and results in lower pressure ratings. Threaded connections should be used only with Sch. 80 or heavier pipe.

"Tite-Joint" Thread Tape should be used for all threaded-connections since screwed fittings tend to bind after long periods of service. Wrap tape around male threads, overlapping about 1/4", until thread length is covered. "Teflon" base thread lubricant also can be used. It is inert and retains its lubricating qualities indefinitely. Squeeze a small amount on male pipe threads, spread with a brush and screw fitting onto pipe.

FLANGED JOINTS

One of the earliest methods for joining plastic pipes, flanging continues to be used extensively, especially for process lines that must be dismantled frequently. Plastic flanges and flanged fittings are available in a full size range and may be attached to pipe by solvent welding, threading or fusion welding.

Flanging is the preferred method of joining plastic-lined piping.

Soft rubber gaskets generally should be used between the flanges.

RECOMMENDED FLANGE BOLT TORQUE FOR PLASTIC FLANGES

FLANGE SIZE	BOLT DIAMETER	TORQUE FT-LB PSI*	FLANGE SIZE	BOLT DIAMETER	TORQUE FT-LB PSI*
1/2"	1/2"	10-15	2 1/2"	5/8"	20-30
3/4"	1/2"	10-15	3"	5/8"	20-30
1"	1/2"	10-15	4"	5/8"	20-30
1 1/4"	1/2"	10-15	6"	3/4"	33-50
1 1/2"	1/2"	10-15	8"	3/4"	33-50
2"	5/8"	20-30	10"	7/8"	53-75

To give bolt stress of 10,000 - 15,000 psi. Bolt torque refers to a well lubricated bolt.

Installation Instructions

GENERAL

The instructions outlined herein pertain to fabricated concrete oil water separators, flush and below grade installations.

NOTE:

The instructions outlined herein have been prepared to alert the contractor and maintenance personnel to procedures which require special attention during erection, operating and maintenance of units.

CAUTION: Any attempt to install, operate and maintain the units without following these instructions may result in damage, failure and improper operation of the units, and will be the sole responsibility of the contractor and/or owner.

It is most important that the site be properly prepared before the arrival of Mack Industries equipment.

BEDDING/BACKFILLING

1. The owner or his representative should consult a geotechnical engineer to verify that the soil has a minimum bearing capacity of 2000 psf. If the soil is not adequate, a special foundation design will be required. The contractor shall alert Mack Industries to this or any other unusual geotechnical requirements prior to production of the unit.

2. The contractor shall follow all county and/or OSHA safety rules in providing temporary shoring of the excavation.
3. The excavation shall be a minimum of 18" wider than the structure on all sides. The bottom of the excavation shall be filled with a minimum 6" thick stone bedding, or equivalent and properly graded to provide a level surface. The excavation shall be kept free of water until the structure is placed and backfilled.
4. Backfill shall be of a suitable compactible material as required by the project specifications. The backfill shall be free of large rocks, wood chunks or frozen lumps. Place the backfill in layers so that the difference in height of backfill is not more than two feet. Tamp each layer to achieve the same density as the surrounding earth using proper compacting techniques. Use **hand operated tampers or compactors - larger units could damage the structure.**

Do not cut holes or fasten equipment without contacting the factory.

When the above described installation procedures are completed, and tank accessories such as pumps, mixers, heater, etc., are installed and checked out, the equipment is ready for operation.

CAUTION: DO NOT START-UP SEPARATOR. SEE START-UP PROCEDURE BEFORE LETTING UNTREATED FLOW ENTER.

C. Pipe Connections

1. All flanged unit connections, unless otherwise noted, provided by Mack Industries are flat face design.
2. All piping running to and from Mack Industries units must be independently supported in order to eliminate strain and stress due to soil conditions or due to pipe contractions and expansions.
3. For plain end connections, use the customer specified attachment.

INSTALLATION

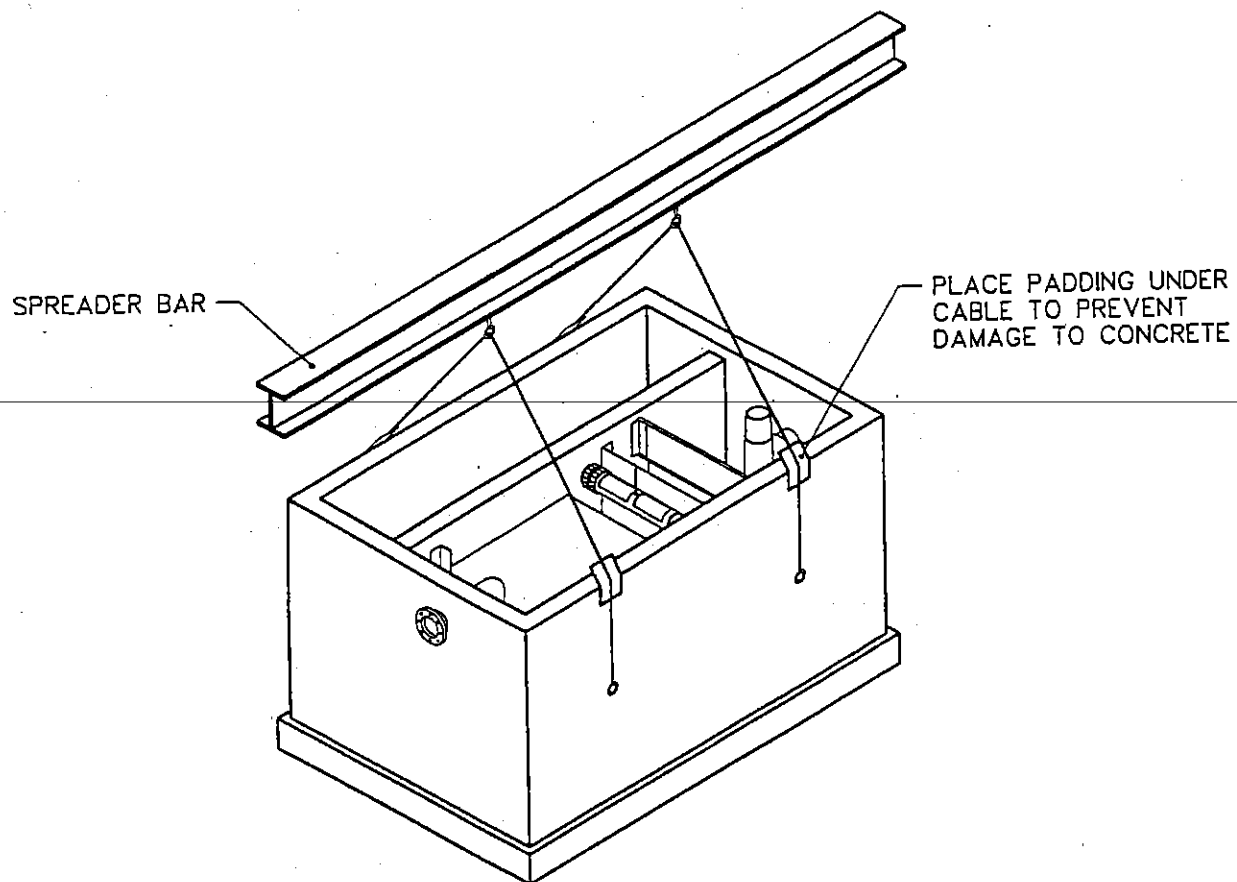
1. Upon arrival, check the separator for any visible damage. Report any damage to the driver. Also see General Instructions for additional information.
2. Lift separator from trailer with crane by connecting chains or cables to the lifting straps provided with the separator. See drawings and specifications in this brochure for number of straps provided/required.

WARNING: IF LIFTING LUGS ARE PROVIDED, USE SPREADER BARS TO ELIMINATE ANY SIDE FORCES ON LIFTING LUGS. FORCE ON LUGS

MUST BE APPLIED IN VERTICAL DIRECTION ONLY. ANY SIDE FORCE ON LIFTING LUGS MIGHT DAMAGE TANK CONSTRUCTION. SEE FIG 3.0 FOR PROPER CABLE/HOOK ATTACHMENT TO LIFTING LUGS.

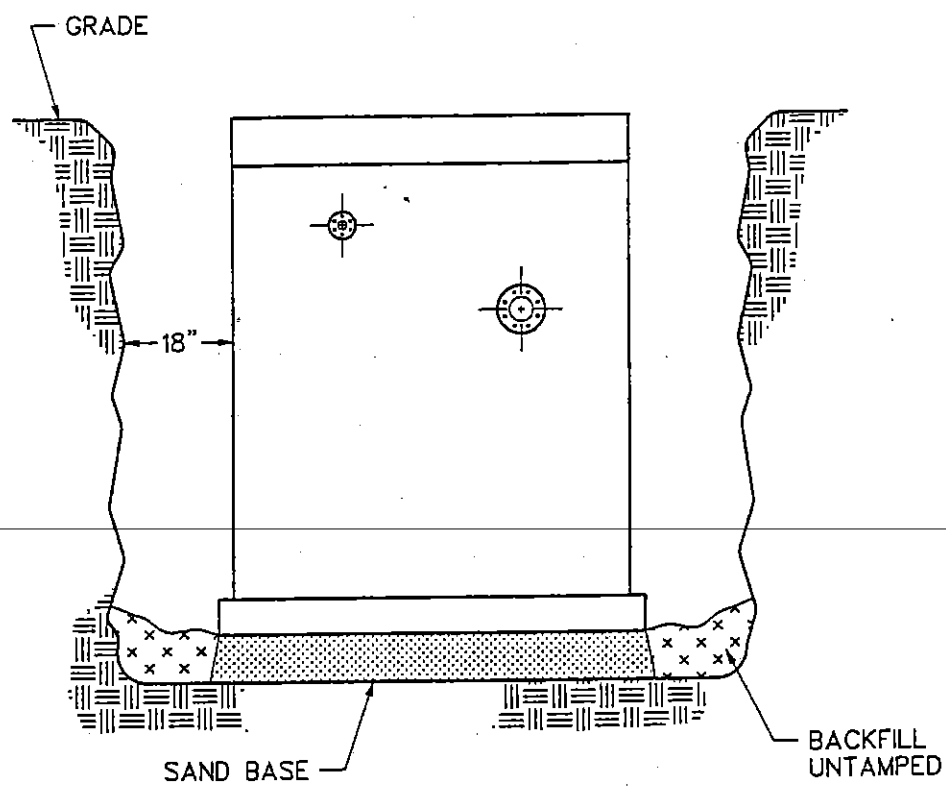
3. Set separator in place, See Fig. 1.0, 2.0, and 3.0.

TYPICAL LIFTING ARRANGEMENT



Mack Industries will supply the best lifting arrangement for each separator application.

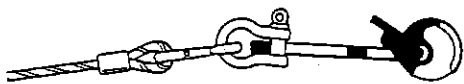
Figure 1.0



Flush with Grade Installation

Figure 2.0

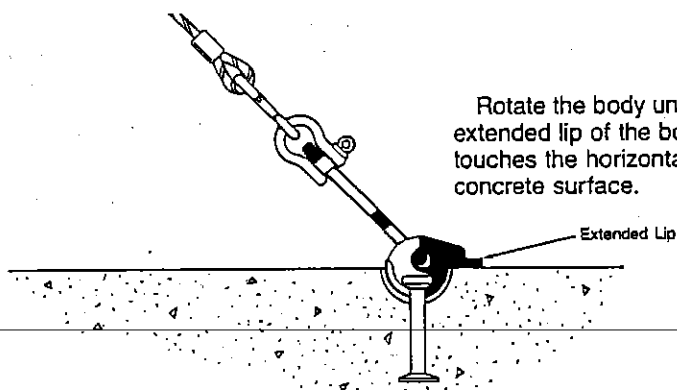
How to Use the SL Universal Lifting Eye



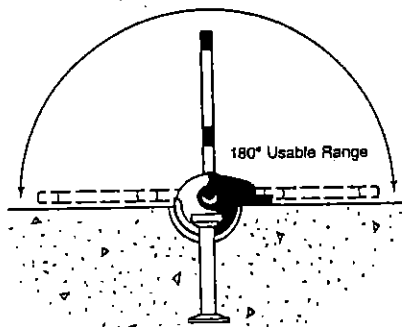
To install the P-50 Universal Lifting Eye, hold the unit upside down with the T-shaped slot of the body directly over the head of the swift lift anchor.



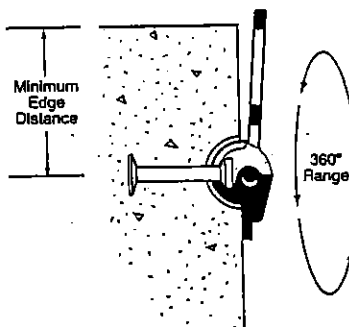
Lower the body of the lifting eye until the T-shaped slot engages the head of the anchor.



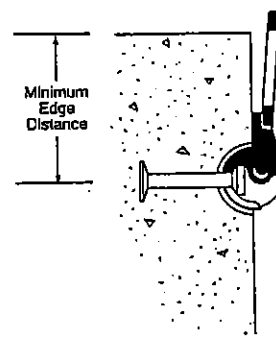
Rotate the body until the extended lip of the body touches the horizontal concrete surface.



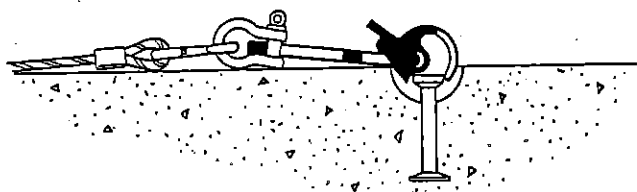
Note that the bail can move throughout a 180° usable range.



Note that the main body of the lifting eye has a 360° rotational range. This feature in combination with the 180° bail movement offers the user unlimited angular crane line loads.



The lifting eye may be safely used with the T-shaped slot facing away from or towards the direction of applied load.



To disengage the lifting eye, the crane hook is lowered and the body removed by rotating the extended lip upward.

LEVELING TANKS

Before piping connections are performed, the tanks must be properly leveled. The allowable deviations shall be

1. Side to Side (Tank width): 1/4"
2. End of End (Tank length): 1/4"

If the tank is equipped with skimmer or other specified equipment, remove shipping braces and tape, and refer to specific instruction in this brochure for installation and adjustment required.

LEVELING WEIR PLATES

Loosen nuts on effluent and oil trough weir plates.

If blind flanges are available, use them on all tank nozzles located below tank water level. If connecting piping to all tank nozzles is supplied with shut-off valves that can isolate the tank, connect piping and close valves.

Fill tank with water. Make sure all tank chambers are filled evenly. Do not exceed tank design flow (see equipment specifications in this brochure when filling tank).

Inspect all weir plates and skimmers, check weir plate levels using water level as reference, adjust as required. Tighten weir plate bolts. Do not overtighten.

Connect all piping if not previously done, see instructions above and check for leaks.

When the above described installation procedures are completed, and tank, accessories, such as pumps, mixers, heaters etc., are installed and checked out, the equipment is ready for operation.

CAUTION: DO NOT START-UP SEPARATOR - SEE START-UP PROCEDURE BEFORE LETTING UNTREATED FLOW ENTER.

Start-Up Procedure

General

Instructions contained herein are of utmost importance to proper operation of all CVTS separators.

Warning

Failure to follow the described procedure may result in improper separator performance, poor effluent quality and the possibility of tube plugging on concrete vertical tube models (CVTS).

Start Up

After the separator installation is completed and all of the piping and pumps are connected and; before the waste stream to be separated is allowed to enter the separator, **ALL OF THE SEPARATOR CHAMBERS INCLUDING THE EFFLUENT CHAMBER MUST BE FILLED (PRIMED) WITH CLEAN WATER.** The clean water may be introduced through manways until the water level reaches the top of the effluent weir.

Caution

Do not fill the oil troughs or the oil storage (slop) tanks.

After the separator is primed, the waste stream may be introduced into the inlet chamber through the inlet connection.

NOTE: The above described separator priming procedure must always be used in cases where the separator has been drained for cleaning, maintenance, or repairs.

Operation Principle

BASIC OPERATING PRINCIPLE

In a nearly motionless state, free oil and water separate because of the natural effects of gravity. Water, being heavier, will settle, and oil, being lighter, will rise. Solids, depending on their density and velocity, will also settle out due to gravity. Mack Industries gravity separators utilize this natural process in a carefully engineered structure. The separators provide a volume through which polluted water and solids flow. The oil accumulates on the top and can be skimmed off, the settleable solids collect on the floor for periodic removal, and the water passes through and is discharged. See assembly drawing in this brochure provided on the unit. The gravity separator model which your company has purchased is a **CONCRETE VERTICAL TUBE Separator (CVTS)**. The following is a description of the various CVTS components and how they function in the system. See Fig. 1.0 for typical flow pattern and components.

CHAMBER WHICH DECREASES THE AMOUNT OF TIME AVAILABLE TO SEPARATE THE OIL, WATER AND SETTLEABLE SOLIDS. THE END RESULT CAN BE A POOR QUALITY EFFLUENT. THEREFORE, THE SEPARATING CHAMBER SHOULD BE CHECKED PERIODICALLY FOR SLUDGE BUILDUP AND THE SLUDGE REMOVED AS NECESSARY.

ROTARY PIPE SKIMMER

If the unit is provided with a rotary pipe skimmer, see separate instruction manual contained in this brochure.

SHEEN BAFFLE

The sheen baffle is designed to capture small oil droplets that might pass under the oil retention baffle.

The buildup of oil at the baffle is so slow that no skimming device is required.

WEIR WALL AND PLATE

The static water level, which occurs when there is no water flowing through the separator, is determined by the weir wall. This level can be adjusted by raising the effluent weir plate. Once the elevation is established, the flow through the separator may be very closely established by measuring, in inches, the differential between the water level and top of the weir plate or the "head", see Fig. 4.0. Once the "head" is established the flows through the unit can be calculated by using the Nomograph on the following page.

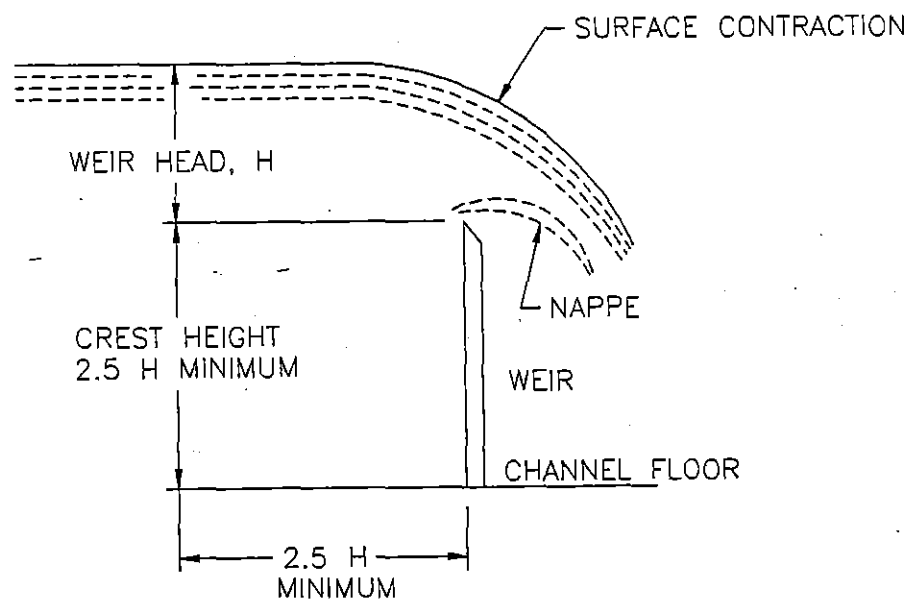
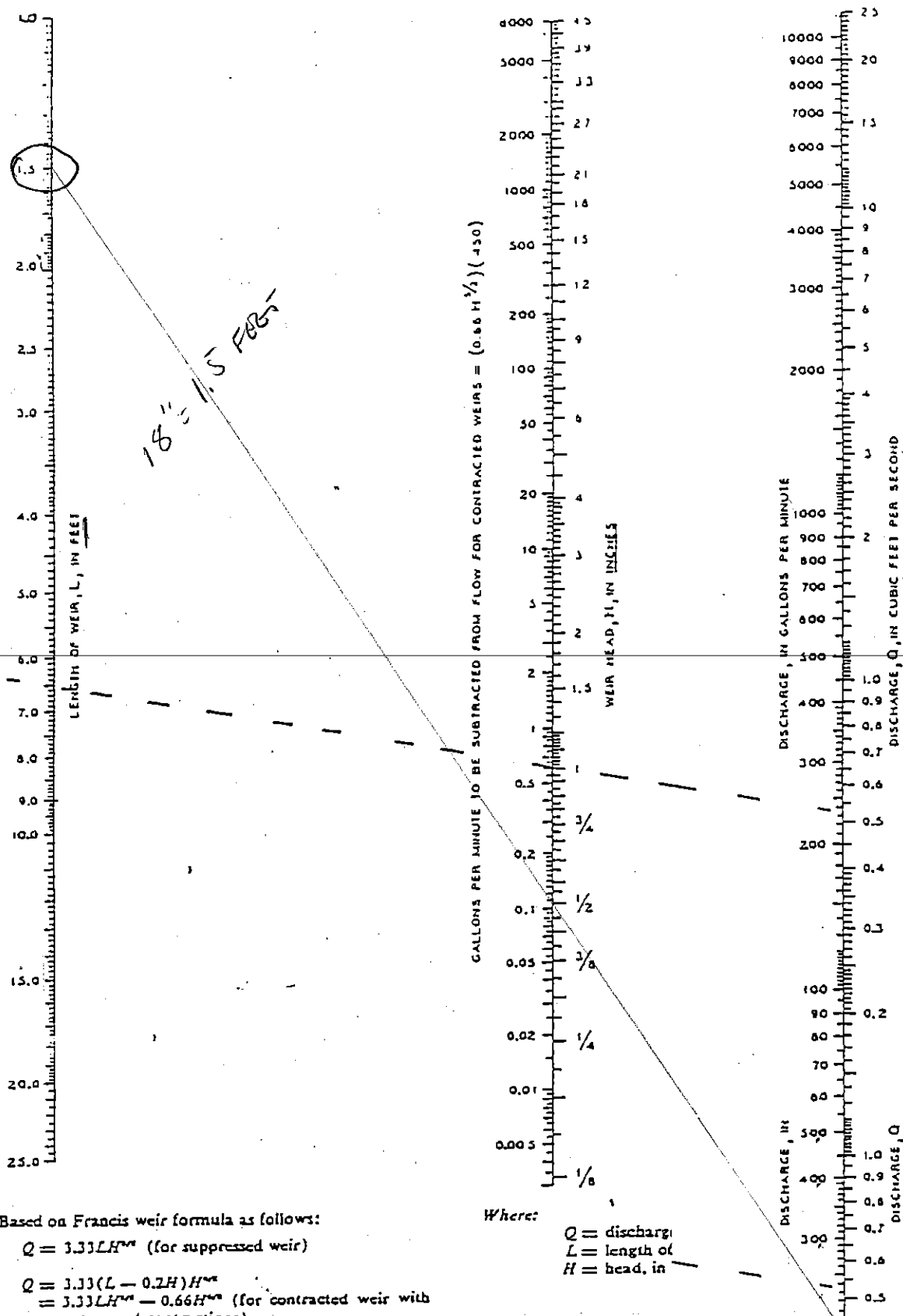


Figure 4.0



NOTE: Based on Francis weir formula as follows:

$Q = 3.33 L H^{3/2}$ (for suppressed weir)

or

$Q = 3.33 (L - 0.2H) H^{3/2}$

$= 3.33 L H^{3/2} - 0.66 H^{5/2}$ (for contracted weir with two end contractions)

Where:

Q = discharge
L = length of
H = head, in

Knowing the "head" over the weir, the flow through the separator can be obtained directly from the Nomograph.

Note: On multiple chamber CVTS separators, the head flow should be multiplied by the number of chambers installed.

Examples:

Given: Weir length 7'-6"

Number of chambers = 2

Measured:

H = head = 1"

Draw a straight line connecting point 7.5' on "Length of Weir" scale and 1" on "Weir Head" scale. Continue the straight line until it intersects "Discharge" scale and read flow in either gpm or ft³/sec.

Flow per chamber, from Nomograph

$Q = 230 \text{ gpm}$

Total flow through separator = $230 \times 2 = 460$

Note: Mack Industries is not responsible for the performance of units operating at flow rates greater than the design flows. An excessive flow rate can result in a poor quality effluent, plus the possible skimming of water if manual (rotary pipe or trough) skimming devices are installed.

Oil removal rates can be increased or decreased by effluent weir plate adjustment.

OUTLET

Clarified water exits the separator through a "T" pipe which allows it to exit through the bottom of the pipe only.

Operational and Maintenance Instructions

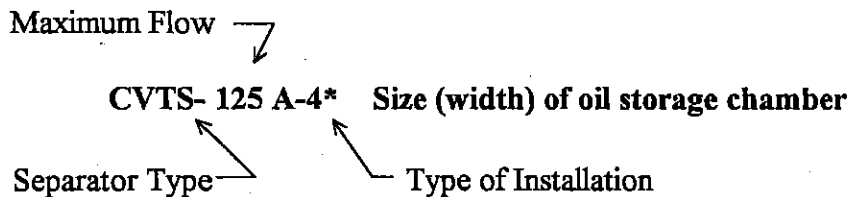
GENERAL

Instructions contained herein pertain to CVTS models designed for flows of 100 gpm and greater. Refer to CVTS assembly drawing contained in this manual and determine model furnished. It will be helpful to become familiar with the part names, their locations, and principles of operation of the separator.

NOMENCLATURE

From the model number given in the equipment specifications contained in this manual, the separator design flows, type of installation, and whether the tank is furnished with an

integral oil (product) storage chamber can be easily determined. The CVTS model coding is as follows:



* **Note:** If this figure is omitted, the separator does not have a storage chamber.

Two basic models of CVTS separators are available: a) individually constructed units designed for flows up to and including 400 gpm and, b) units designed for flows greater than 400 gpm and constructed as described below.

CVTS MODELS DESIGNED FOR FLOWS GRATER THAN 400 GPM

Construction

Models designed for flows grater than 400 gpm are constructed using two or more chambers consisting of units rated for flows of 400 gpm or less.

The chambers are integrally enclosed in one envelope and are, as standard, partitioned into symmetrical sections for proper flow distribution.

Each module is identical in cross section and is designed to process an equal fraction of the total incoming flow.

On identical chamber construction, each section may have the same size inlet and outlet nozzles located at the same elevation and located with respect to each module, or may be furnished with one inlet nozzle and an internal manifold for directing flow to individual chambers.

In order to equalize hydraulic loadings, the partition walls that are separating the chambers are designed with equalizing slots (openings) which are located in the influent and effluent chamber on units with isolated chambers or one equalizing opening in separating chamber partition wall when units are provided with internal inlet manifold.

The oil collection troughs are also connected through the partition walls and act as one unit.

OPERATION

1. With the hook-up of the inlet, oil, water outlet, and surge connections, the separator is ready for operation. The separator does not have any moving (or rotating) parts and therefore, no special precautions, except periodic checking and cleaning are required for a satisfactory performance.

2. Sediment buildup in the separation chamber should be checked and removed when a five or six inch accumulation is reached.

3. Sludge buildup withdrawal from the separation chamber can be accomplished through a sludge draw-off pipe, located in the separation chamber and extended above the coalescing tubes or through side walls. The draw-off pipe is flanged and can be attached to a mating flange of a pump section.

If a flanged pump suction pipe is not available, the pump suction hose can be inserted into the draw-off pipe for sludge withdrawal.

The inlet chamber should be inspected periodically for sludge accumulation. Sludge and solids should be removed as required.

4. Coalescing Tubes Removal: Before tubes can be removed, the top grating, holding the tubes, must be unbolted and removed.

Tube packs then are removed individually. After tubes are removed, the bottom grating supporting tube packs should also be removed. A vacuum truck or similar sludge removal means should be used for sludge removal. The tubes should be placed back in the separation chamber and the unit put back in operation.

Coalescing tubes should also be periodically inspected and cleaned. A good indication that the tubes need cleaning is a decrease in effluent quality, providing the unit is operated at design flows, or water backing up at the inlet and separation chamber. For proper cleaning, the tube packs should be removed and steam cleaned or pressure washed. When pressure washing, use bio-degradable cleaning detergents suitable for grease and oil.

NOTE: In most cases it is not necessary to empty the separator for cleaning. The separator has been designed to collect solids in specific areas. Solids should be pumped or vacuumed from the collection areas.

1. Sludge level accumulation in the influent and separation chamber should be periodically checked.

2. Oil trough and oil discharge opening(s) or nozzles should be inspected periodically for debris accumulation and plugging.

3. On constructed modular units the flow equalization ports/slots should be periodically checked for plugging.

4. If pumps, skimmers or other auxiliary equipment is furnished with the separator check and lubricate equipment as required by manufacturer or as described in separate instructions contained in this manual.

NOTE: For additional instructions on operation and maintenance of the separator, refer to the Troubleshooting Guide contained in this manual.

Troubleshooting Guide

INTRODUCTION

After selection and installation of the appropriate oil/water separator, there may be instances when the unit does not appear to be functioning at the expected performance level. Generally, these problems stem from a readily correctable mechanical malfunction. In an effort to make these solutions more readily found, this problem troubleshooting guide has been compiled.

A. FREE OIL IN THE EFFLUENT

<u>Cause</u>	<u>Remedy</u>
1. CVTS Tubes above the water level	
a. Water level too low	Raise discharge weir
b. Tubes floating	Check grating to be sure it is in place and is weighing down all tube packs
2. Skimmers not removing oil	Weir plate skim edge should be 1/8" above water line or adjusted to desired elevation Leading edge should be just above water line
3. Oil build-up behind sheen baffle	Remove oil by manual skimmer or siphoning, oil sorbents, or other means
4. Weirs not level	Adjust for an even water/oil flow over weir
5. Excessive flow through unit	Reduce flow rate to design rate

B. WATER BACKING UP AT INLET CHAMBER

<u>Cause</u>	<u>Remedy</u>
1. CVTS tubes blinded	
a. High solids level	Remove tube packs and clean. Determine source of solids and possibility of recurrence. Was it an

- b. Algae build-up

2. Excessive flow

accidental dump, a recurrent dump, or a process change?

Remove tube packs and clean.
If a recurrent problem, a commercial algaecide may be required

Reduce flow to within ratings

C. FOAMING

Cause

1. Cleaners/surfactants

- a. Batch dump

- b. Process change

Remedy

Flush system. Determine recurrence probability. A commercial antifoam may be needed

Return to former products. Low-foaming substitutes may be possible. If not, an anti-foam may be required

2. Air in piping

- a. Pumps drawing air

- b. Opening/leak in piping

3. Polymer overdose

Raise liquid level, reduce flow

Seal leak/hole

Reduce chemical feed rate. Check that solution strength, mixing feed rates, and pumps are all in order.

D. SOLIDS IN EFFLUENT

Cause

1. Sludge build-up beyond recommended level

- a. Manual removal

- b. Pump-out package

Remedy

Clean tank compartments, remove remove sludge

Increase maintenance frequency

Check for correct operation of level sensors, timers, pumps, piping. Increase draw-off rate if necessary

2. Solids not settling

a. Excessive flow and decreased retention time

Reduce flow rate

b. Particles too fine or light to settle

Use a coagulant aide type of polymer, or increase dosage if already in use

E. EMULSIFIED OIL IN EFFLUENT

Cause

1. Mechanical emulsification

a. Pump throttled down too far

Open valve that is reducing flow; put pump on timer for intermittent flow; or change pump size or type

b. Mixers

Reduce speed; change impeller number, size, or configuration; or put mixer on a timer for intermittent mixing.

2. Chemical emulsification

a. Synthetic coolants

If accidental, one-time dump - flush system. If recurrent problem - segregate from general wastestream; return to prior process; investigate effectiveness of chemical treatment.

b. Cleaners/surfactants

If accidental, one-time dump - flush system. If recurrent problem - segregate and/or treat chemically or return to former cleaners.

ROTARY PIPE SKIMMER

Design

The MACK Rotary Pipe Skimmer (RPS) is designed to remove products such as oil, animal fats and floc from MACK type separators, clarifiers or skim tanks. This style is ideal for heavy or viscous product, and the best operation is achieved when specific gravity's between liquid and material to be skimmed are great.

Constructed entirely of corrosion-proof materials, (see equipment specifications for type of construction materials furnished), the RPS can operate in a wide variety of environments with minimal maintenance.

MANUAL OPERATION

The operation of the RPS requires periodic checks of the product level in the tank. The operator decides how much of the product he wants to collect in the tank before skimming. When the product level is sufficiently thick to operate the skimmer, the skimmer is rotated about its axis and the skimming edge lowered into the product. As the product spills into the skimmer, it flows by gravity out of the skim pipe, through the wall of the separator, and into a product storage tank for accumulation and subsequent removal. The operator must maintain a watch on the product being skimmed. When water appears to be entering the skimming pipe, the skimmer must be rotated to an up-right or non-skim position. Automatic skimming is possible, but requires a continuously thick product level as described below.

AUTOMATIC SKIMMING - UNATTENDED OPERATION

Automatic operation is recommended only on applications where the specific gravity of oil and/or material to be skimmed is known, will not change during operation, and the flow through the unit will remain constant.

To adjust the Rotary Pipe Skimmer for automatic operation, the skimming edge of the skimmer pipe should be set 1/4" above maximum water level (at design flow), see Separator Operating Instructions in this brochure for procedures to calculate maximum liquid level.

With this setting, the skimming operation will be continuous the moment the oil layer floating on the surface is greater than 1/4".

MAINTENANCE

1. Periodically check skimmer assembly and make sure skimmer level and attitude have not changed.
2. Check scum and grease accumulation in pipe and outlet connection weekly and scrape or hose the assembly when required.

RPS Operation & Maintenance Instructions

GENERAL

Refer to manual skimmer assembly drawing on a specific tank installation included in this brochure. It will be helpful to become familiar with part names and their location.

NOMENCLATURE

The letter following the MACK model, RP, designates the axis about which the skimmer rotates. The model described in this instruction is RP-C, or concentric axis and designates skimmer rotation about centerline of skimmer pipe which coincides with oil outlet pipe centerline. See Fig. 1.0 for a typical skimmer assembly and component parts.

SKIMMER COMPONENTS

Model RP-C skimmers consist of five major components as described below and shown in Fig. 1 and 2.

1. Skimmer pipe with 90 slots, Item 3
2. Mounting bracket complete with trunnion, Item 2
3. Compression coupling, Item 4, as shown in Fig. 1
4. Outlet discharge connection
5. Adjustment handle, Item 5

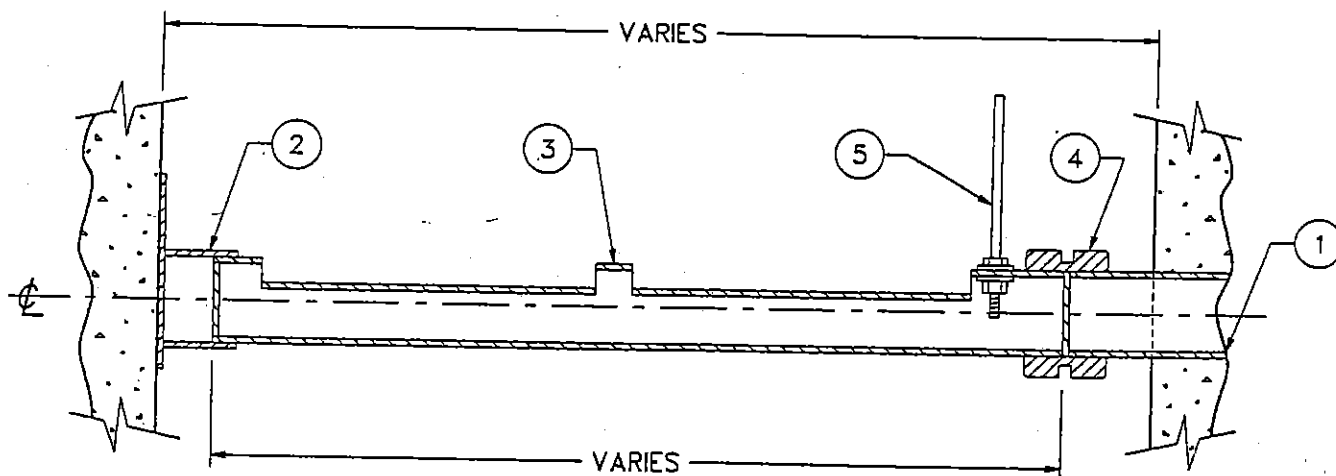


Figure 1.0 Skimmer Assembly

INSTALLATION

Depending on contract requirements, skimmer assembly may be shipped factory installed in Mack Industries process tank or separately for field installation in a designated location. Check equipment specifications and drawings and determine how the skimmer was ordered and follow accordingly.

A. Factory Installed Skimmers

1. Install and level the tank, see tank installation instructions in this brochure, and connect all required piping, controls, valves, etc.
2. Remove tape and support braces.
3. Check skimmer for rotation, skimmer should not rotate freely since the friction in the swivel joints maintains skimmer position.
4. Position skimmer with the handle in vertical position, as shown in Fig. 2.0.
5. Skimmer is ready for operation

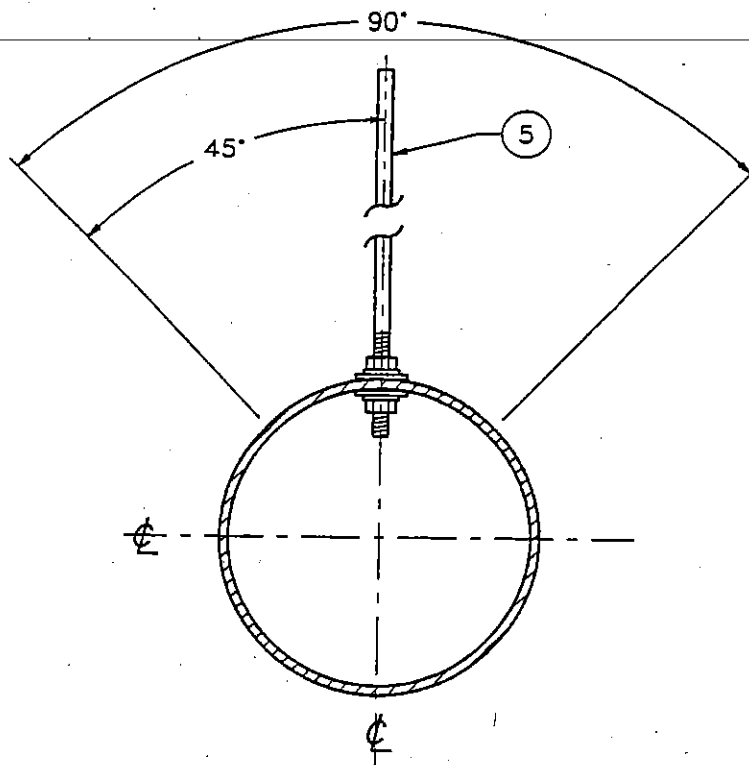
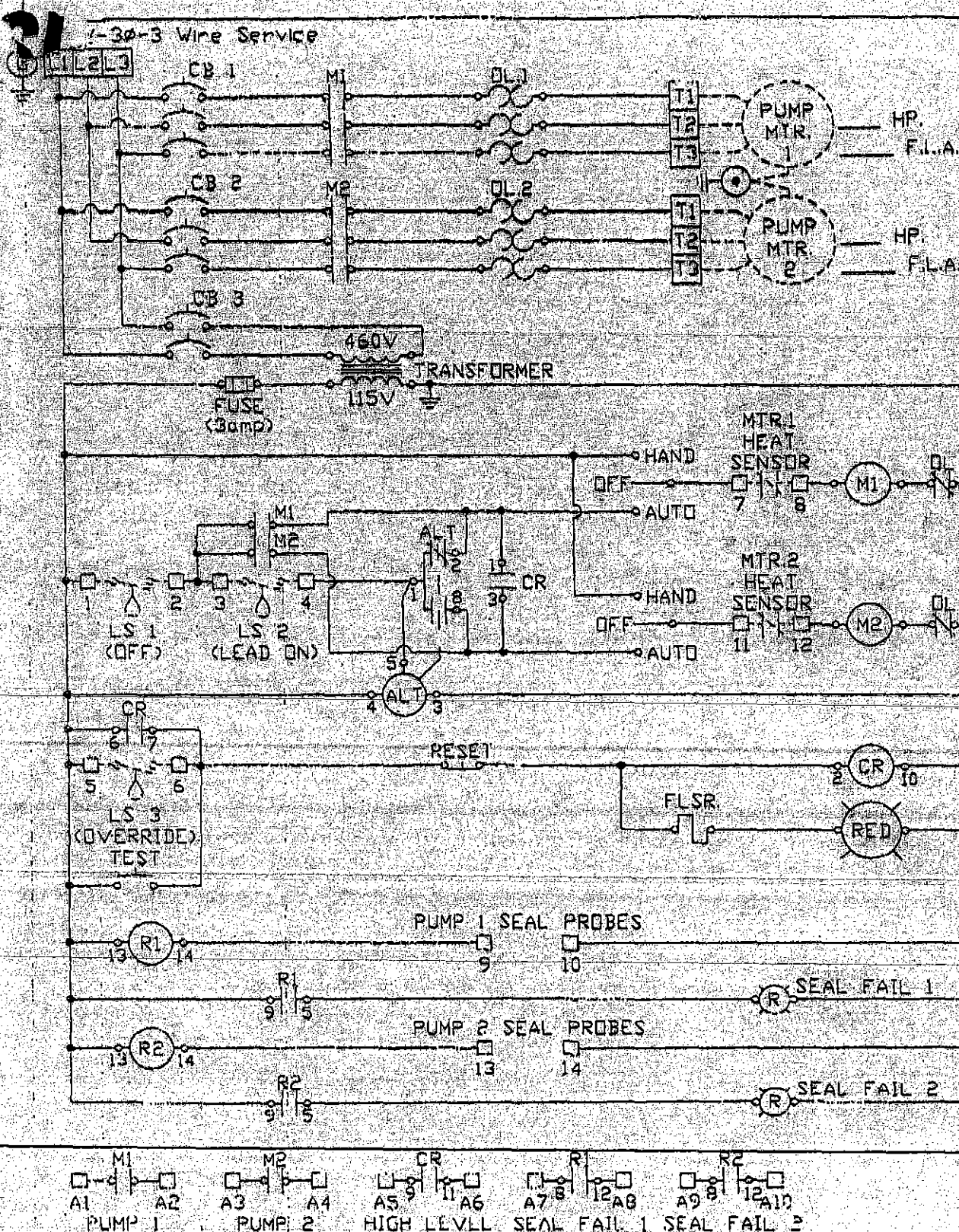


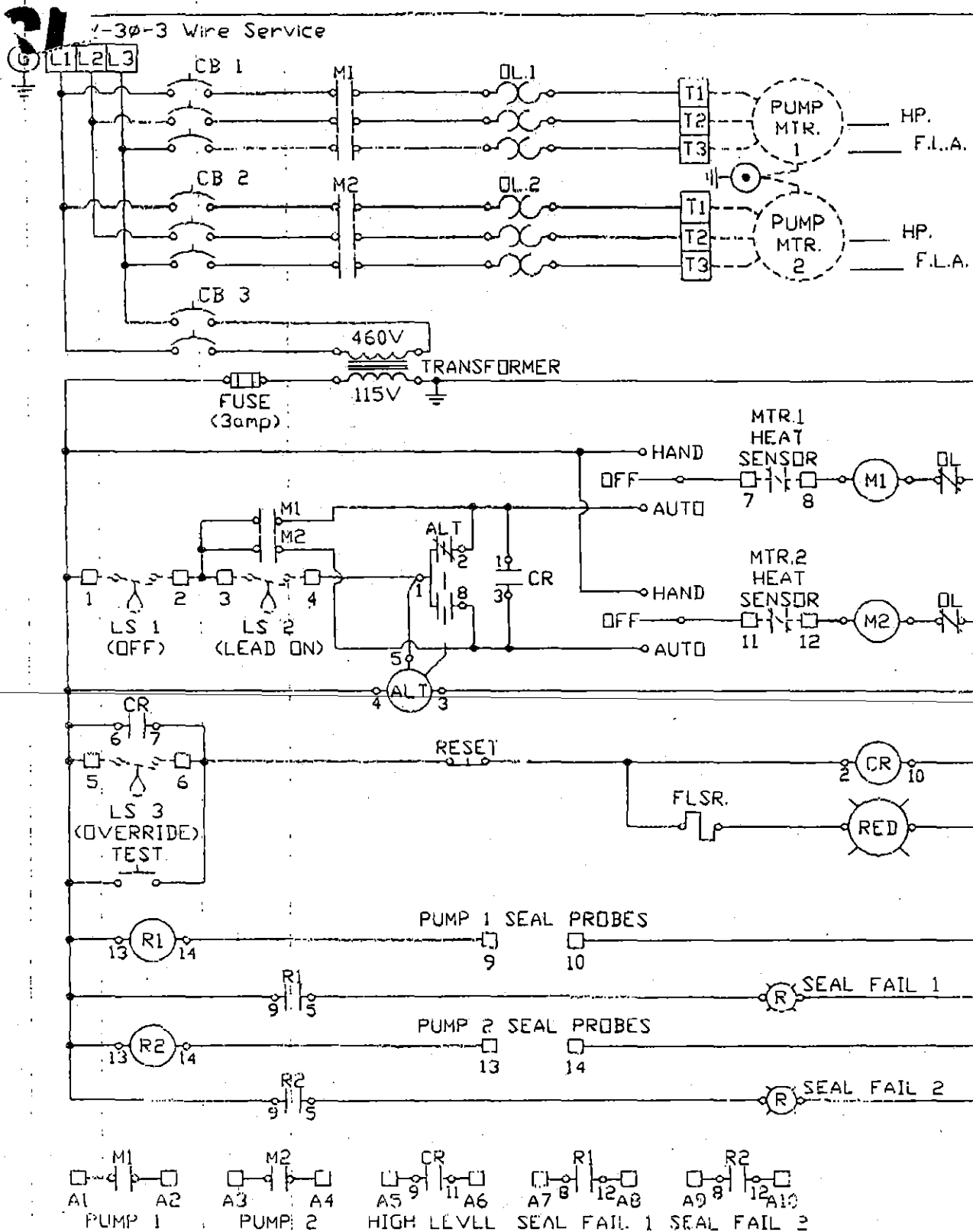
Figure 2.0

1-30-3 Wire Service



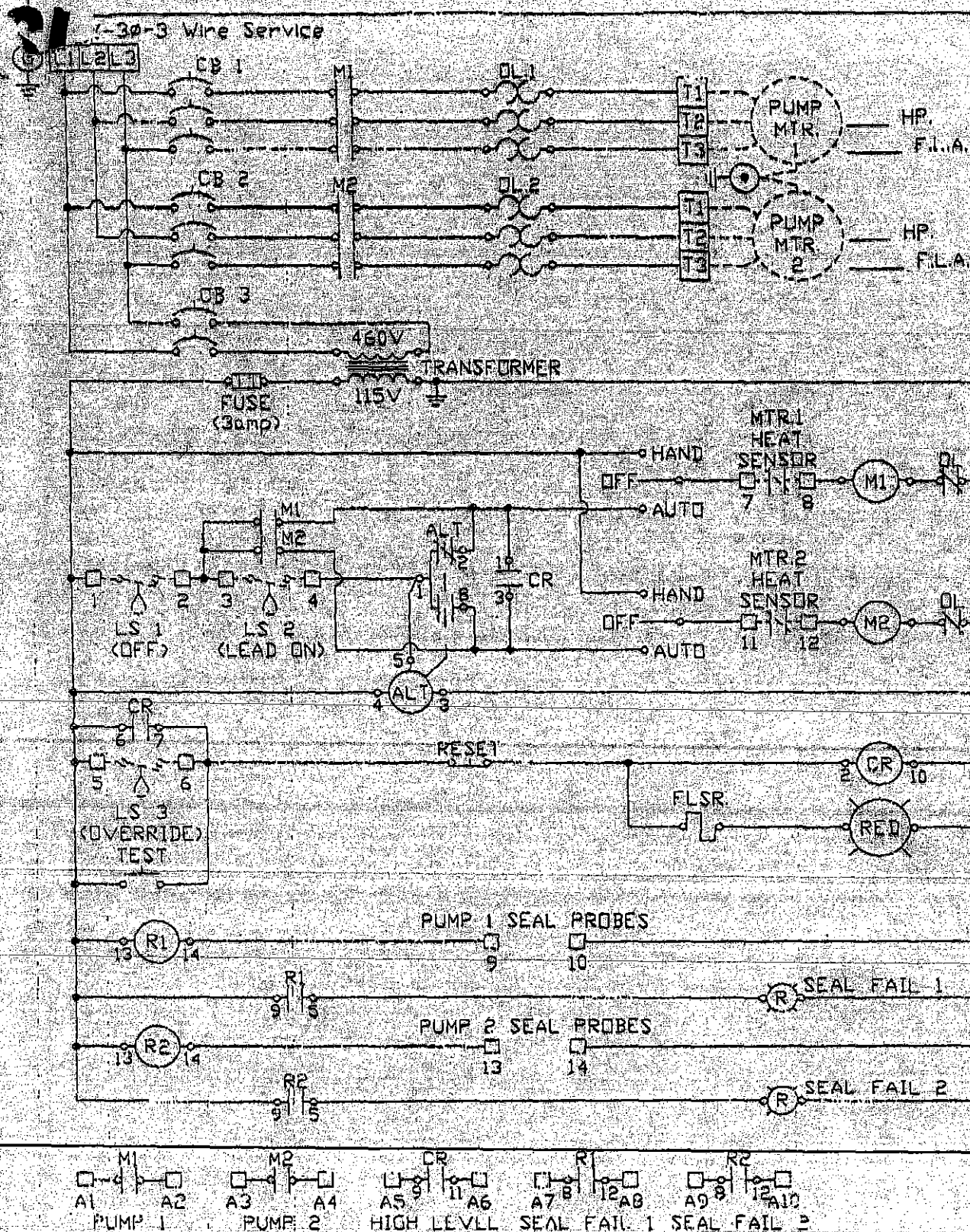
1) Level Switches Must Be Rated A Minimum Of 2 Amps @ 120 Volts.
 2) Torque All Union Field Wiring Terminals To 20 in. Lbs.
 3) Field Wiring Must Be 60°C Copper Wire Minimum.
 4) Temp Not Supplied In Panel

DRWN.	DATE	Chandler Systems, Inc.	
TAD	11/20/95		
CHKD.	DATE	SCALE	DRWG. NO.
		NONE	A-MACK14



1) Overload Switches Must Be Rated A Minimum Of 2 Amps @ 120 Volts.
2) Torque All White Field Wiring Terminals To 20 In. Lbs.
3) Field Wiring Must Be 60°C Copper Wire Minimum.
4) ----- = Items Not Supplied In Panel

DRWN.	DATE	Chandler Systems, Inc.	
TAD	11/20/95		
CHKD.	DATE	SCALE	DRWG. NO.
		NONE	A-MACK14



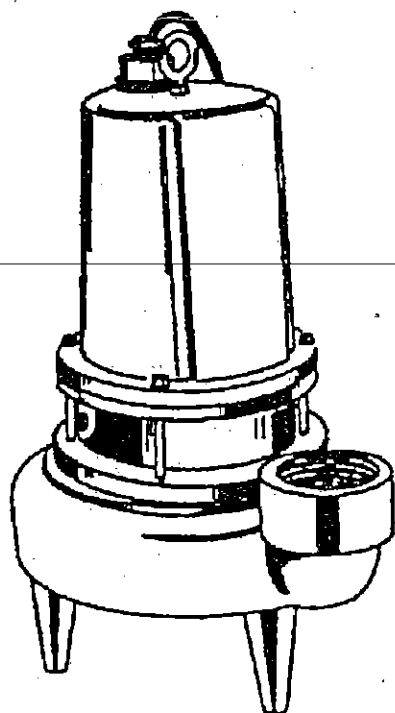
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DRWN.	DATE	Chandler Systems, Inc.	
TAD	11/20/95		
CHKD.	DATE	SCALE	DRWG. NO.
		NONE	A-MACK14

BARNES[®]

INSTALLATION and OPERATION MANUAL

Submersible Sewage Ejector



SERIES: 3SE
1.5 and 2.0 HP
1750 RPM
(Double Seal)

IMPORTANT: Read all instructions in this manual before operating pump.

As a result of Barnes® Pumps constant product improvement program, product changes may occur. As such Barnes Pumps reserves the right to change product without prior written notification.

CRANE

PUMPS & SYSTEMS

Barnes Pumps, Inc.
420 Third Street/P.O. Box 603
Piqua, Ohio 45356-0603
Phone: (513) 773-2442
Fax: (513) 773-2238

CDF005820



Form No. 088889-0994

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SPECIAL TOOLS AND EQUIPMENT

INSULATION TESTER (MEGGER)
DIELECTRIC TESTER
SEAL TOOL KIT (see parts list)
PRESSURE GAUGE KIT (see parts list)

SAFETY FIRST!

PLEASE READ THIS BEFORE INSTALLING OR OPERATING PUMP.

GENERAL

1. Most accidents can be avoided by using **COMMON SENSE**.
2. Read the operation and maintenance instruction manual supplied with the pump.
3. Do not wear loose clothing that may become entangled in the impeller or other moving parts.
4. Always wear appropriate safety gear, such as safety glasses, when working on the pump or piping.

PUMPS

5. Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.
6. Only qualified personnel should install, operate and repair pump.
7. Keep clear of suction and discharge openings. **DO NOT** insert fingers in pump with power connected.
8. Do not pump hazardous materials (flammable, caustic, etc.) unless the pump is specifically designed and designated to handle them.
9. Do not block or restrict discharge hose-be careful of discharge hose whipping under pressure.
10. Make sure lifting handles are securely fastened each time before lifting.
11. Do not lift pump by the power cord.
12. Do not exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.
13. Secure the pump in its operating position so it can not tip over, fall or slide.
14. Keep hands and feet away from impeller when power is connected.
15. Submersible Pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common.
16. Do not operate pump without guards and safety devices in place.
17. When towing pump behind a vehicle; make sure hitch is properly attached, always attach safety chains.
18. Always replace safety devices that have been removed during service or repair.

ELECTRICAL

19. To reduce risk of electrical shock, pump must be properly grounded in accordance with the National Electric Code and all applicable state and local codes and ordinances.
20. To reduce risk of electrical shock, always disconnect the pump from the power source before handling or servicing.
21. Any wiring of pumps should be performed by a qualified electrician.
22. Never operate a pump with a power cord that has frayed or brittle insulation.
23. Cable should be protected at all times to avoid punctures, cut, bruises and abrasions - inspect frequently.
24. Never handle connected power cords with wet hands.
25. Never operate a pump with a plug-in type power cord without a ground fault circuit interrupter.

GAS/DIESEL ENGINE POWER PUMPS ONLY

26. Never operate in an enclosed building or area where exhaust gases can accumulate.
27. Do not breath exhaust fumes when working in the area of the engine. (Exhaust gases are odorless and deadly poison.)
28. Never operate near a building where exhaust gases can seep inside.
29. Never operate in a pit or sump without making provisions for adequate ventilation.
30. Allow exhaust system to cool before touching.
31. Never add fuel to the tank while the engine is running. Stop engine and allow to cool.
32. Do not smoke while refueling the engine.
33. Do not refuel near open flame.

IMPORTANT! Barnes® Pumps, Inc. is not responsible for losses, injury, or death resulting from a failure to observe these safety precautions, misuse or abuse of pumps or equipment.

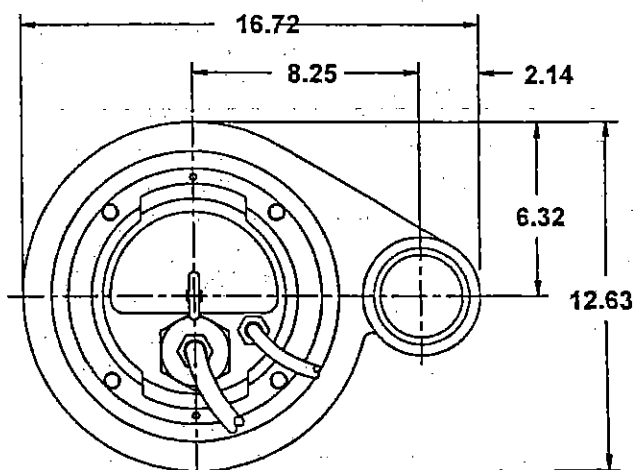
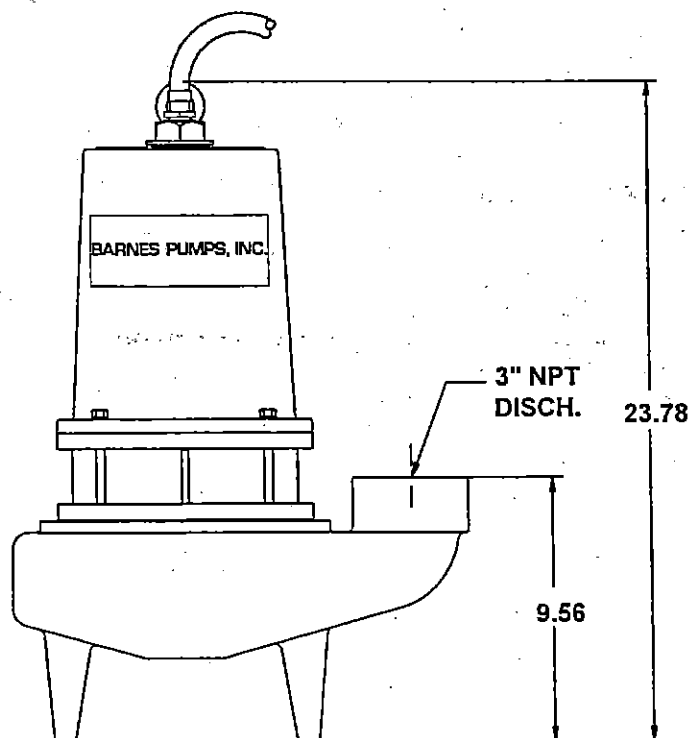
SECTION: A- PUMP SPECIFICATIONS

DISCHARGE: 3" NPT, Vertical
LIQUID TEMPERATURE: 104° F Continuous.
VOLUTE: Cast Iron ASTM A-48, Class 30.
MOTOR HOUSING: Cast Iron ASTM A-48, Class 30.
SEAL PLATE: Cast Iron ASTM A-48, Class 30.
IMPELLER:
 Design: 2 Vane, Open, With Pump Out Vanes On Back Side. Dynamically Balanced. ISO G6.3.
 Material: Cast Iron ASTM A-48, Class 30.
SHAFT: 416 Stainless Steel
SQUARE RINGS: Buna-N
HARDWARE: 300 Series Stainless Steel
PAINT: Air Dry Enamel.
SEAL: *Design:* Tandem Mechanical, Oil Filled Reservoir.
 Material: Rotating Faces - Carbon
 Stationary Faces - Ceramic
 Elastomer- Buna-N
 Hardware -300 Series Stainless
CABLE ENTRY: 25 ft. Cord, Pressure Grommet for Sealing and Strain Relief.
SPEED: 1750 RPM (Nominal).

UPPER BEARING:
 Design: Single Row, Ball
 Lubrication: Oil
 Load: Radial
LOWER BEARING:
 Design: Single Row, Ball
 Lubrication: Oil
 Load: Radial & Thrust
MOTOR: *Design:* NEMA L-Single Phase, NEMA B-Three Phase Torque Curve. Completely Oil-Filled, Squirrel Cage Induction.
 Insulation: Class B.
SINGLE PHASE: Permanent Split Capacitor (PSC). Includes Overload Protection In Motor.
THREE PHASE: Tri Voltage 200-230/460; Requires Overload Protection to be Included in Control Panel.
MOISTURE SENSOR: N/O, Requires Relay in Control Panel.
TEMPERATURE SENSOR: N/C, Requires Relay in Control Panel.
OPTIONAL EQUIPMENT: Seal Material, Impeller Trims, Additional Cable, CSA Listed.



® Canadian Standards Association
 File No. LR16567



SECTION B: GENERAL INFORMATION

B-1) To the Purchaser:

Congratulations! You are the owner of one of the finest pumps on the market today. Barnes® Pumps are products engineered and manufactured of high quality components. Over ninety-five years of pump building experience along with a continuing quality assurance program combine to produce a pump which will stand up to the toughest applications.

This Barnes Pumps, Inc. manual will provide helpful information concerning installation, maintenance, and proper service guidelines.

B-2) Receiving

Upon receiving the pump, it should be inspected for damage or shortages. If damage has occurred, file a claim immediately with the company that delivered the pump. If the manual is removed from the crating, do not lose or misplace.

B-3) Storage:

Short Term- Barnes Pumps are manufactured for efficient performance following long inoperative periods in storage. For best results, pumps can be retained in storage, as factory assembled, in a dry atmosphere with constant temperatures for up to six (6) months.

Long Term- Any length of time exceeding six (6) months, but not more than twenty four (24) months. The units should be stored in a temperature controlled area, a roofed over walled enclosure that provides protection from the elements (rain, snow, wind blown dust, etc.), and whose temperature can be maintained between +40 deg. F and +120 deg. F.

If extended high humidity is expected to be a problem, all exposed parts should be inspected before storage and all surfaces that have the paint scratched, damaged, or worn should be recoated with a water base, air dry enamel paint. All surfaces should then be sprayed with a rust-inhibiting oil.

Pump should be stored in its original shipping container and on initial start up, rotate impeller by hand to assure seal and impeller rotate freely.

If it is required that the pump be installed and tested before the long term storage begins, such installation will be allowed provided:

- 1) The pump is not installed under water for more than one (1) month.
- 2) Immediately upon satisfactory completion of the test, the pump is removed, thoroughly dried, repacked in the original shipping container, and placed in a temperature controlled storage area.

B-4) SERVICE CENTERS:

For the location of the nearest Barnes Pumps Service Center, check your catalog, your Barnes Pumps, Inc. representative or Barnes Pumps, Inc. Service Department in Piqua, Ohio, telephone (513) 773-2442.

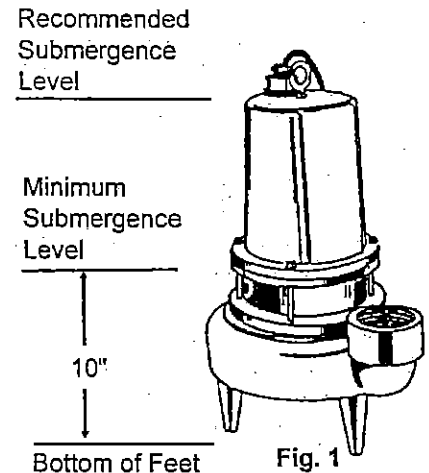
SECTION C: INSTALLATION

C-1) Location:

These pumping units are self-contained and are recommended for use in a sump, lift station or basin. This pump is designed to pump sewage, effluent, or other nonexplosive or noncorrosive wastewater and shall **NOT** be installed in locations classified as hazardous in accordance with the National Electrical Code (NEC), ANSI/NFPA 70. Never install the pump in a trench, ditch or hole with a dirt bottom; the legs will sink into the dirt and the suction will become plugged.

C-1.1 Submergence:

It is recommended that the pump be operated in the submerged condition and the sump liquid level should never be less than dimension "A" in Figure 1.



C-2) Discharge:

Discharge piping should be as short as possible. Both a check valve and a shut-off valve are recommended for each pump being used. The check valve is used to prevent backflow into the sump. Excessive backflow can cause flooding and/or damage to the pump. The shut-off valve is used to stop system flow during pump or check valve servicing.

Barnes Pumps supplies a breakaway fitting discharge system designed to allow the submersible wastewater pump to be installed or removed without requiring personnel to enter the wet well.

Place the Break Away Fitting (BAF) in position. Temporarily secure the guide rails in the upper mounting brackets and locate the base on the bottom of the wet well. Level the base with grout and/or shims. Install the intermediate support brackets, if required. Make sure the rails are in a true vertical position so the pump will clear the access opening and will slide freely down the rails into place on the discharge stationary fitting. Once the rails are in proper alignment, bolt the base into the floor of the station and connect the discharge pipe to the elbow.

Connect the movable portion and other supplied fittings of the BAF onto the pump and lower into wet well. See the Break Away Fitting manual for more information.

C-3) Liquid Level Controls:

The level controls are to be supported by a mounting bracket that is attached to the sump wall, cover or junction box. Cord grips are used to hold the cords in place on the mounting bracket. The control level can be changed by loosening the grip and adjusting the cord length as per the plans and specifications. Be certain that the level controls cannot hang up or foul in it's swing and that the pump is completely submerged when the level control is in the "Off" mode.

C-4) Electrical Connections:

WARNING!

All model pumps and control panels must be properly grounded per the National Electric Code, state and local codes. Improper grounding voids warranty.

C-4.1) Power Cable:

The cord assembly mounted to the pump must not be modified in any way except for shortening to a specific application. Any splice between the pump and the control panel must be made in accordance with the National Electric Code and all applicable state and local electric codes. It is recommended that a junction box, if used, be mounted outside the sump or be of at least Nema 4 construction if located within the wet well.

Do not use the power cable to lift pump.

NOTE: The white wire is **NOT** a neutral or ground lead, but a power carrying conductor.

C-4.2) Control Cable:

The cord assembly mounted to the pump must not be modified in any way except for shortening to a specific application. Any splice between the pump and the control panel must be made in accordance with the National Electric Code and all applicable state and local electric codes. It is recommended that a junction box, if used, be mounted outside the sump or be of at least Nema 4 construction if located within the wet well.

MODEL NO.	HP	VOLT	PH	RPM (Nom)	NEMA CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CORD TYPE	CORD OD	EMERSON WINDING RESISTANCE MAIN-START	G.E. WINDING RESISTANCE MAIN-START
3SE1524DS	1.5	230	1	1750	C	16.0	44.6	10/3	SO	0.690	1.21-2.80	
3SE1594DS	1.5	200-230	3	1750	D/G	13.3/11.6	35.8/41.2	10/4	SO	0.750	2.21-	2.23-
3SE1544DS	1.5	460	3	1750	G	5.8	20.6	10/4	SO	0.750	8.84-	8.92-
3SE1554DS	1.5	575	3	1750	G	4.6	16.4	10/4	SO	0.750	13.79-	13.95-
3SE2024DS	2.0	230	1	1750	A	19.0	44.6	10/3	SO	0.690	1.21-2.80	
3SE2094DS	2.0	200-230	3	1750	B/D	15.2/13.2	35.8/41.2	10/4	SO	0.750	2.21-	2.23-
3SE2044DS	2.0	460	3	1750	D	6.6	20.6	10/4	SO	0.750	8.84-	8.92-
3SE2054DS	2.0	575	3	1750	D	5.2	16.4	10/4	SO	0.750	13.79-	13.95-

Winding Resistance $\pm 5\%$

Standard Units:

Standard - Moisture & Temperature Sensor cable for all models is 18/5 SO, 0.476 OD.

Optional - Temperature sensor cable for 3 phase models is 14/2 SOW-A, 0.530 O.D., CSA Listed

CSA Listed Units:

Optional - CSA Listed Power Cable for 1 Phase models is 10/3 SOW-A, 0.690 O.D.

Optional - CSA Listed Power Cable for 3 Phase Models is 10/4 SOW-A, 0.745 O.D.

Optional - CSA Listed Moisture & Temperature Sensor cable for all models is 18/5 SOW, 0.476 OD.

Do not use the control cable to lift pump.

NOTE: The white wire is NOT a neutral or ground lead, but a power carrying conductor.

C-4.3) Overload Protection :

C-4.3-1) Three Phase- The normally closed (N/C) thermal sensor is embedded in the motor windings and will detect excessive heat in the event an overload condition occurs. The thermal sensor will trip when the windings become too hot and will automatically reset itself when the pump motor cools to a safe temperature. It is recommended that the thermal sensor be connected in series to an alarm device to alert the operator of an overload condition, and/or the motor starter coil to stop the pump. In the event of an overload, the source of this condition should be determined and rectified immediately.

DO NOT LET THE PUMP CYCLE OR RUN IF AN OVERLOAD CONDITION OCCURS !

C-4.3-2) Single Phase- The type of in-winding overload protector used is referred to as an inherent overheating protector and operates on the combined effect of temperature and current. This means that the overload protector will trip out and shut the pump off if the windings become too hot, or the load current passing through them becomes too high. It will then automatically reset and start the pump up after the motor cools to a safe temperature. In the event of an overload, the source of this condition should be determined and rectified immediately.

DO NOT LET THE PUMP CYCLE OR RUN IF AN OVERLOAD CONDITION OCCURS !

C-4.4) Moisture Sensors:

A normally open (N/O) detector is installed in the pump seal chamber which will detect any moisture present. It is recommended that this detector be connected in series to an alarm device or the motor starter coil to alert the operator that a moisture detect has occurred. In the event of a moisture detect, the pump should be pulled and the source of the failure located and repaired.

DO NOT LET THE PUMP OPERATE IF A MOISTURE DETECT HAS OCCURRED !

Temperature Sensor Electrical Ratings

Volts	Continuous Amperes	Inrush Amperes
110-120	3.00	30.0
220-240	1.50	15.0
440-480	0.75	7.5

SECTION: D START-UP OPERATION

D-1) Check Voltage and Phase:

Before operating pump, compare the voltage and phase information stamped on the pump's identification plate to the available power.

D-2) Check Pump Rotation:

Before putting pump into service for the first time, the motor rotation must be checked. Improper motor rotation can result in poor pump performance and can damage the motor and/or pump. To check the rotation, suspend the pump freely, momentarily apply power and observe the "kickback". "Kickback" should always be in a counter-clockwise direction as viewed from the top of the pump motor housing.

D-2.1) Incorrect Rotation for Three-Phase Pumps:

In the event that the rotation is incorrect for a three-phase installation, interchange any two power cable leads at the control box. **DO NOT** change leads in the cable housing in the motor. Recheck the "kickback" rotation again by momentarily applying power.

D-2.2) Incorrect Rotation for Single-Phase Pumps:

In the unlikely event that the rotation is incorrect for a single phase pump, contact a Barnes Pumps Service Center.

D-3) Start-Up Report:

Included at the end of this manual are two start-up report sheets, these sheets are to be completed as applicable. Return one copy to Barnes Pumps, Inc. and store the second in the control panel or with the pump manual if no control panel is used. It is important to record this data at initial start-up since it will be useful to refer to should servicing the pump be required in the future.

D-3.1) Identification Plate:

Record the numbers from the pump's identification plate on both START-UP REPORTS provided at the end of the manual for future reference.

D-3.2) Insulation Test:

Before the pump is put into service, an insulation (megger) test should be performed on the motor. The resistance values (ohms) as well as the voltage (volts) and current (amps) should be recorded on the start-up report.

D-3.3) Pump-Down Test:

After the pump has been properly wired and lowered into the basin, sump or lift station, it is advisable to check the system by filling with liquid and allowing the pump to operate through it's pumping cycle. The time needed to empty the system, or pump-down time along with the volume of water, should be recorded on the start-up report.

SECTION E: PREVENTATIVE MAINTENANCE

As the motor is oil filled, no lubrication or other maintenance is required, and generally Barnes Pumps will give very reliable service and can be expected to operate for years on normal sewage pumping without failing. However as with any mechanical piece of equipment a preventive maintenance program is recommended and suggested to include the following checks:

- 1) Inspect motor and seal chamber for oil level and contamination and repair as required per section F-1.
- 2) Inspect impeller and body for excessive build-up or clogging and repair as required per section F-2.
- 3) Inspect motor and bearings and replace as required per section F-3.
- 4) Inspect seal for wear or leakage and repair as required per section F-4.

SECTION F: SERVICE AND REPAIR

NOTE: All item numbers in () refer to Figures 8 & 9.

WARNING !

ELECTRICAL POWER TO THE PUMP MOTORS MUST BE DISCONNECTED AND LOCKED OUT TO PREVENT ANY DANGEROUS ELECTRICAL HAZARDS OR PERSONNEL DANGER BEFORE ANY SERVICE WORK IS DONE TO THE PUMP.

CAUTION !

OPERATING PUMP BUILDS UP HEAT AND PRESSURE; ALLOW TIME FOR PUMP TO COOL TO ROOM TEMPERATURE BEFORE HANDLING OR SERVICING.

F-1) Lubrication:

Anytime the pump is removed from operation, the cooling oil in the motor housing (5) should be checked visually for oil level and contamination.

F-1.1) Checking Oil:

Motor Housing- To check oil, set unit upright. Remove gland nut (30a) see Fig. 5, from hex nut (16). Unscrew hex nut (16) from motor housing (5). **DO NOT** disconnect wiring from motor leads. With a flashlight, visually inspect the oil in the motor housing (5) to make sure it is clean and clear, light amber in color and free from suspended particles. Milky white oil indicates the presence of water. Oil level should be to bottom of plug (19) Fig. 9, when pump is in vertical position.

F-1.2) Testing Oil:

1. Place pump on it's side, remove pipe plug (19), from motor housing (5) and drain oil into a clean, dry container.
2. Check oil for contamination using an oil tester with a range to 30 Kilovolts breakdown.
3. If oil is found to be clean and uncontaminated (measure above 15 KV. breakdown), refill the motor housing as per section F-1.3.
4. If oil is found to be dirty or contaminated (or measures below 15 KV. breakdown), the the pump must be carefully inspected for leaks at the shaft seals (31), cable assemblies (30) and (32), and hex nut (16), O-rings (8) and pipe plugs (19), before refilling with oil. To locate the leak, perform a pressure test as per section F-1.4. After leak is repaired, refill with new oil as per section F-1.3.

WARNING !

DO NOT OVERFILL OIL

Overfilling of motor housing with oil can create excessive and dangerous hydraulic pressure which can destroy the pump and create a hazard. Overfilling oil voids warranty.

F-1.3) Replacing Oil:

Motor Housing- Drain all oil from motor housing and dispose of properly. Set unit upright and refill with (see parts list for amount) new cooling oil as per Table 1. Fill to pipe plug (19), on motor housing (5), level as an air space must remain in the top of the motor housing to compensate for oil expansion (see Fig. 9). Apply pipe thread compound to threads of hex nut (16) and pipe plug (19) then assemble to motor housing (5). Insert friction ring (30b), grommet (30c), another friction ring (30b), and gland nut (30a) into hex nut (16) and torque to 15 ft. lbs.

Seal Chamber- Set unit on its side with fill plug (19) downward, remove plug (19) and drain all oil from seal chamber. Set unit on its side, with plug (19) upward, and refill completely with (see parts list for amount) new oil as per Table 1. Apply pipe thread compound to threads of pipe plug (19) and assemble to spacer (50).

Table 1

COOLING OIL- Dielectric	
Supplier	Grade
BP	Enerpar SE40
Conoco	Pale Paraffin 22
Mobil	D.T.E. Oil Light
G & G Oil	Cirulating 22

F-1.4) Pressure Test:

Motor Housing- Before checking the pump for leaks around the shaft seal, square rings, and cord inlet, the oil level should be full as described in section F-1.3. Remove pipe plug (19) from motor housing (5). Apply pipe sealant to pressure gauge assembly and tighten into hole (see Fig. 2). Pressurize motor housing to 10 P.S.I. Use a soap solution around the sealed areas and inspect joints for "air bubbles".

If, after five minutes, the pressure is still holding constant, and no "bubbles" are observed, slowly bleed the pressure and remove the gauge assembly. Replace the pipe plug (19) using a sealant. If the pressure does not hold, then the leak must be located and repaired.

Seal Chamber- Remove pipe plug (19) from spacer (50) and check that the seal chamber is full of oil. Apply pipe sealant to pressure gauge assembly and tighten into hole in spacer (50). Pressurize seal chamber to 10 P.S.I. and check for leaks as outlined above.

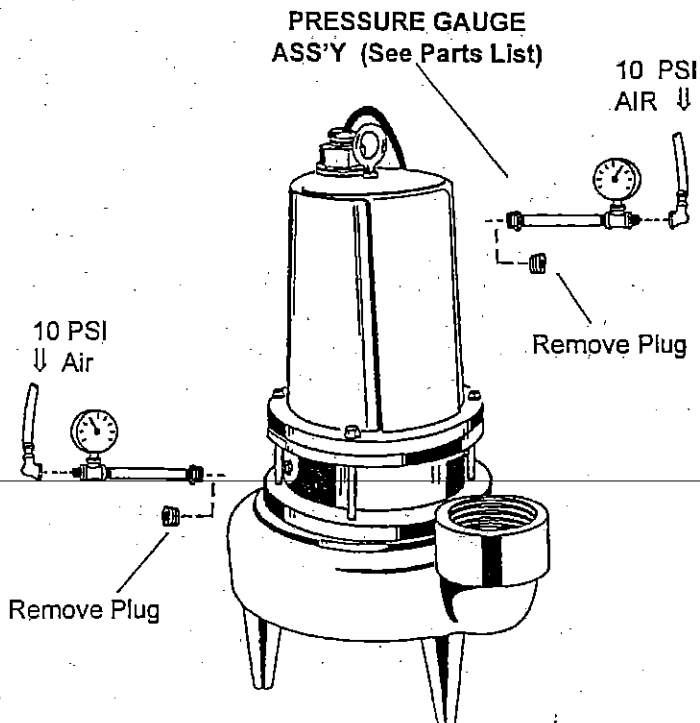


Fig. 2

CAUTION !
ALWAYS WEAR EYE PROTECTION WHEN WORKING ON PUMPS.

CAUTION !
PRESSURE BUILDS UP EXTREMELY FAST, INCREASE PRESSURE BY "TAPPING" AIR NOZZLE. TOO MUCH PRESSURE WILL DAMAGE SEAL. DO NOT EXCEED 10 P.S.I.

F-2) Impeller and Volute Service:**F-2.1) Disassembly and Inspection:**

To clean out volute (24) or replace impeller (29), disconnect power, remove hex nuts(12), and lockwasher (11), vertically lift motor and seal plate assembly from body (24). Clean out body if necessary. Clean and examine impeller (29), for pitting or wear and replace if required, inspect gasket (10) and replace if cut or damaged. If the impeller (29) needs replacing, remove nut (3), place a flat screwdriver in the slot of the end of the shaft to hold the shaft stationary while unscrewing the impeller (29).

F-2.2) Reassembly:

To install impeller (29), screw impeller onto the shaft hand tight. Clean the threads with Loctite cleaner. Apply thread locking compound to shaft threads and install nut (3). Torque to 40 ft. lbs. Rotate impeller to check for binding. Position gasket (10) on volute flange and position impeller and motor housing on volute (28). Position lockwasher (11) on cap screw (12) and screw into volute (28). Torque to 8 ft. lbs. Check for free rotation of motor and impeller.

F-3) Motor and Bearing Service

F-3.1) Disassembly and Inspection:

To examine or replace the motor (20) and bearings (6) and (42), disassemble volute and impeller as outlined in paragraph F-2.1. Drain oil from motor and seal chamber as outlined in paragraph F-1.3. Disassemble shaft seal as outlined in paragraph F-4.1.

Position unit upright, using blocks to avoid resting unit on shaft. Remove socket head cap screws (9). Vertically lift the outside motor housing (5) from seal plate (52) by lifting eye (17). Inspect square ring (8) for damage or cuts. Remove cable assembly (30) by unscrewing gland nut (30a), gland nut (32a), and hex nut (16) from motor housing (5). Remove cable lead wires from motor lead wires and sensors wires from control cable by disconnecting connectors (23) and (40). The unit voltage should be noted. Remove the motor bolts and lift motor (20) from seal plate (52). Examine bearing (6) and replace if required. If replacement is required, remove retaining ring (2) then remove bearing (6) from motor shaft using a wheel puller or arbor press.

Vertically lift motor stator from rotor. Inspect bearing (42), belleville washers (43) and spacer (44) if replacement is required, remove belleville washers (43) and spacer (44) from motor shaft, remove bearing (42) from motor shaft using a wheel puller or arbor press. Inspect winding for shorts and check resistance values. To test the temperature sensor (if equipped), check for continuity between the black and white wires. If found to be defective contact a motor service station or Barnes Pumps service department. Check rotor for wear. If rotor or the stator windings are defective, the complete motor must be replaced. Check motor capacitor (21), on single phase units and replace if defective. Check moisture sensors (46) for damage and replace if necessary.

IMPORTANT !

ALL PARTS MUST BE CLEAN BEFORE REASSEMBLY.

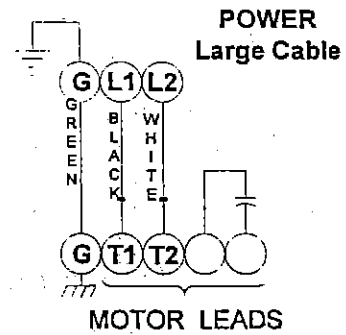
F-3.2) Reassembly:

Bearings- When replacing bearings, be careful not to damage the rotor or shaft threads. Clean the shaft thoroughly. Apply adhesive compound to the shaft and press bearing (6) on the motor shaft, position squarely onto the shaft applying force to the inner race of the bearing only, until bearing seats against the retaining ring (2). Apply adhesive compound to the other end of motor shaft and press bearing (42) on, positioning squarely on the shaft shoulder, applying force to inner race of bearing only. Position belleville washer (43), spacer (44) and another belleville washer (43), with curvatures pointing away from spacer (44), on motor shaft above bearing (42) and lower motor stator over rotor.

Motor- Slide lower bearing (6) and motor (20) squarely into the seal plate (1) until bearing seats on the bottom. Torque motor bolts to 17 inch pounds. Make wire connections per paragraph F-3.3. Set square ring (8) in groove on seal plate (1), lower motor housing (5) down onto seal plate (1) while aligning holes. Place socket head cap screws (9) through seal plate (1) into motor housing (5) and torque to 60 inch pounds.

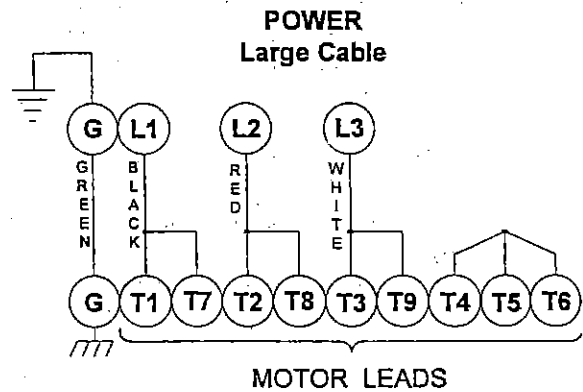
SINGLE PHASE, 115/230 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1
White	2
Flag Terminal	Capacitor
Flag Terminal	Capacitor



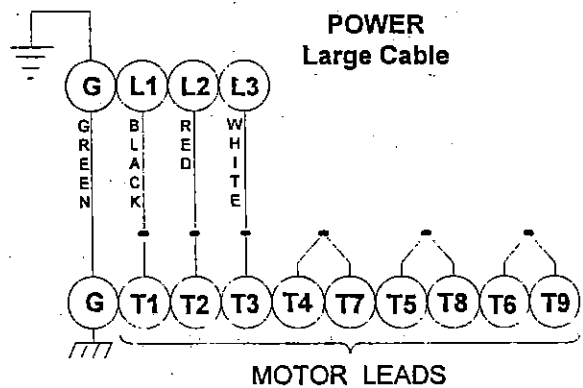
THREE PHASE, 200/230 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1 & 7
Red	2 & 8
White	3 & 9
	4, 5 & 6 Together



THREE PHASE, 460 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1
Red	2
White	3
	4 & 7 Together
	5 & 8 Together
	6 & 9 Together



TEMPERATURE SENSOR ONLY

Control Cable (32)	Lead Number
Black	P1 (Thermo Sensor)
White	P2 (Thermo Sensor)

CONTROL Small Cable Temperature Sensor Leads

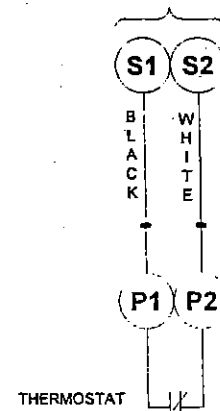


Fig. 3

CDF005831

MOISTURE & TEMPERATURE SENSORS

Control Cable (32)

Black
White
Red
Orange
Green

Lead Number

P1 (Thermo Sensor)
P2 (Thermo Sensor)
W1 (Moisture Sensor)
W2 (Moisture Sensor)
Ground

CONTROL Small Cable

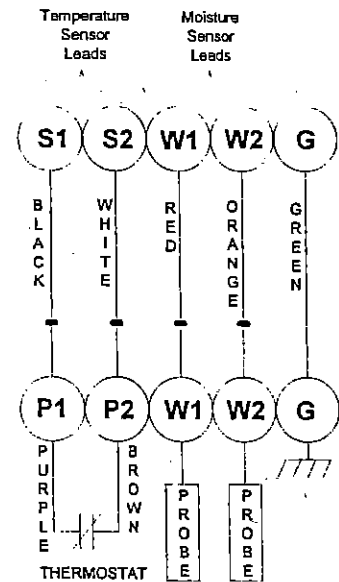
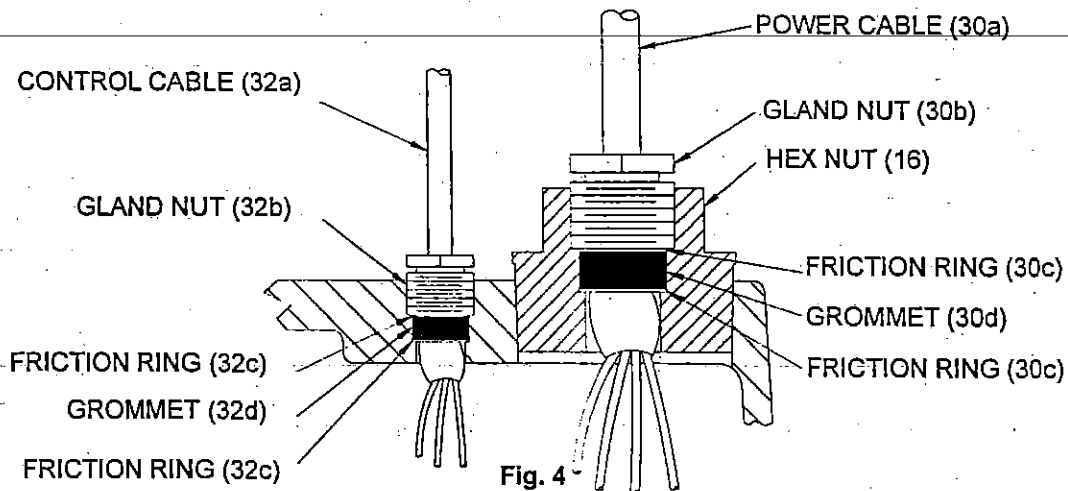


Fig. 3 Cont.



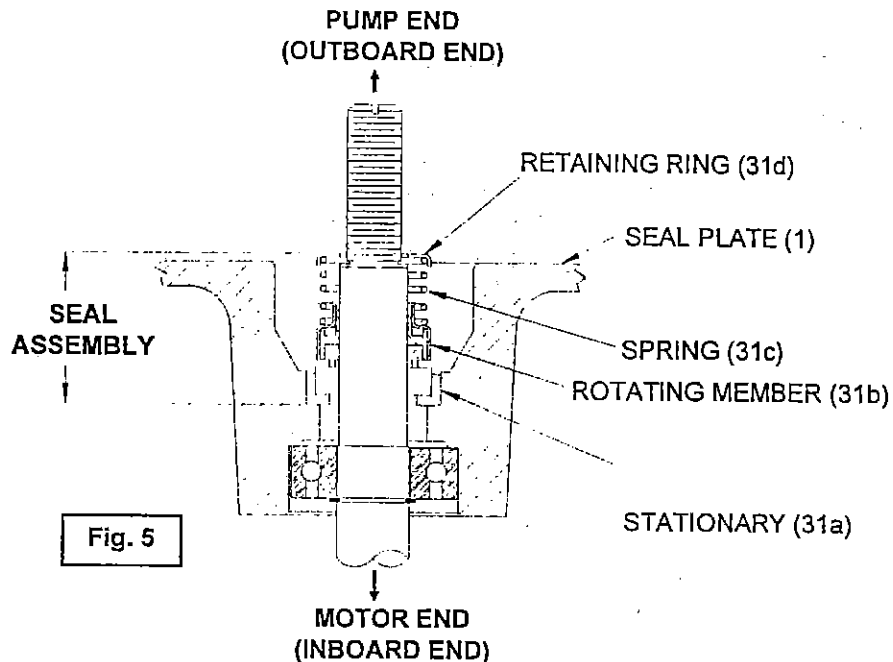
F-3.3) Wiring Connections:

Check power cable (30) and control cable (32) for cracks or damage and replace if required (see Fig. 4). Place parts (30a,b&c) and hex nut (16) on power cord (30), and parts (32a,b &c) on control cable (32). Bring cord sets (30) and (32) through opening in top of motor housing (5), and reconnect motor leads to power cable (30) and sensor leads to control cable (32) using connectors (23), and in addition use (40) and (41) for 3 phase, as show in Fig. 3.

F-3.4) Cable Assemblies:

Power Cable- Refill with cooling oil (if it has been drained) as outlined in paragraph F-1.3. Make wire connections as outlined in paragraph F-3.3. Apply thread locking compound to hex nut (16) and tighten into motor housing (5). Insert one friction ring (30c), grommet (30d), another fiction ring (30c) and gland nut (30b) into hex nut (16) and tighten gland nut (30b) to 15 ft. lbs. to prevent water leakage (see Fig. 4).

Control Cable- Insert one friction ring (32c), grommet (32d), one friction ring (32c) and gland nut (32b) into motor housing (5). Torque gland nut (32b) to 15 ft. lbs. to prevent water leakage.



F-4) Shaft Seal Service:

CAUTION !
HANDLE SEAL PARTS WITH EXTREME CARE. DO NOT SCRATCH OR
MAR LAPPED SURFACES.

F-4.1) Disassembly and Inspection:

OUTER SEAL-To expose outer shaft seal (31) for examination disassemble volute and impeller as outlined in paragraph F-2.1. If further repair is required remove retaining ring (31d), spring (31c) and rotating member (31b) from shaft (see Fig. 5). Examine all seal parts and especially contact faces. Inspect seal for signs of wear such as uneven wear pattern on stationary members, chips and scratches on either seal face. **DO NOT** interchange seal components, replace the entire shaft seal (31). If replacing seal, remove stationary (31a) by prying out with flat screw driver.

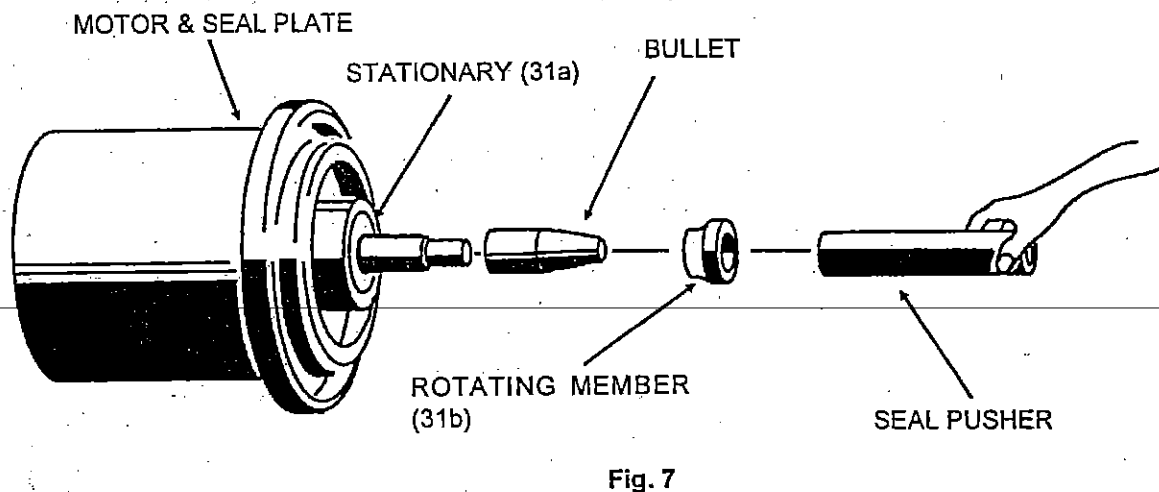
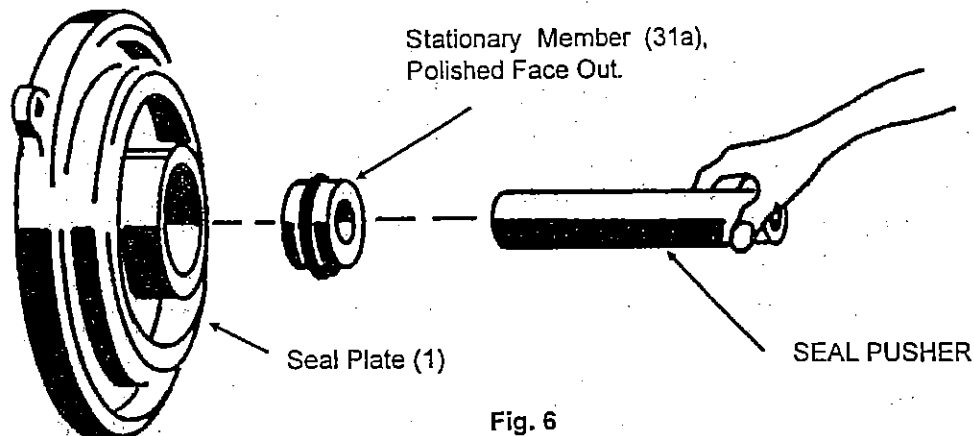
INNER SEAL- To expose inner shaft seal (31) for examination, remove outer seal as outlined above. Remove socket head cap screw (51). Lift seal plate (1), spacer (50) and square rings (8) from seal plate (52). If replacement is required remove retaining ring (49), retaining ring (31d), spring (31c) and rotating member (31b) from shaft. Examine as outlined in outer seal paragraph.

F-4.2) Reassembly:

Seal- Clean and oil seal cavities in seal plate (1). Lightly oil (**DO NOT** use grease) outer surface of stationary member (31a). Press stationary member (31a) firmly into seal plate (1), using a seal pusher (see parts list-Seal Tool kit), nothing but the seal pusher is to come in contact with seal face (see Fig. 6).

IMPORTANT !
DO NOT HAMMER ON THE SEAL PUSHER- IT WILL DAMAGE THE
SEAL FACE.

Make sure the stationary member is in straight. Slide a bullet (see parts list-seal tool kit) over motor shaft. Lightly oil (**DO NOT** use grease) shaft, bullet and inner surface of bellows on rotating member (31b) see Fig. 7. With lapped surface of rotating member (31b) facing inward toward stationary member (31a), slide rotating member (31b) over bullet and onto shaft, using seal pusher, until lapped faces of (31a) and (31b) are together (see Fig. 5).



It is extremely important to keep seal faces clean during assembly. Dirt particles lodged between these faces will cause the seal to leak.

Place spring (31c) over shaft and in place on rotating member (31b), making sure it is seated on retainer and not cocked or resting on bellows tail. Slide retaining ring (31d) over shaft and let rest on spring (31c). Replace retaining ring (49) onto shaft. Set one square ring (8) in groove on seal plate (52) and lower spacer (50) onto seal plate (52). Seat one square ring (8) onto groove on spacer (50) and lower seal plate (1) onto spacer (50). Insert two socket head cap screws (51) and torque to 60 inch pounds. Repeat insertion of seal for outer seal. Assemble impeller and volute as outlined in paragraph F-2.2. Replace oil as outlined in paragraph F-1.3.

TROUBLE SHOOTING

CAUTION ! Always disconnect the pump from the electrical power source before handling.

If the system fails to operate properly, carefully read instructions and perform maintenance recommendations. If operating problems persist, the following chart may be of assistance in identifying and correcting them: **MATCH "CAUSE" NUMBER WITH CORRELATING "CORRECTION" NUMBER.**

PROBLEM	CAUSE	CORRECTION
Pump will not run	<ol style="list-style-type: none"> Poor electrical connection, blown fuse, tripped breaker or other interruption of power; improper power supply. Motor or switch inoperative (to isolate cause, go to manual operation of pump). <ol style="list-style-type: none"> Float movement restricted Switch will not activate pump or is defective. Defective motor. Insufficient liquid level. 	<ol style="list-style-type: none"> Check all electrical connections for security. Have electrician measure current in motor leads, if current is within $\pm 20\%$ of locked rotor Amps, impeller is probably locked. If current is 0, overload may be tripped. Remove power, allow pump to cool, then recheck current. Reposition pump or clean basin as required to provide adequate clearance for float.
Pump will not turn off	<ol style="list-style-type: none"> Float switch movement restricted. Switch will not de-activate pump or is defective. Excessive inflow or pump not properly sized for application. Pump may be airlocked. Switch is in "HAND" position. 	<ol style="list-style-type: none"> Disconnect level control. Set ohmmeter for a low range, such as 100 ohms full scale and connect to level control leads. Actuate level control manually and check to see that ohmmeter shows zero ohms for closed switch and full scale for open switch.
Pump hums but doesn't run	<ol style="list-style-type: none"> Incorrect voltage. Impeller jammed or loose shaft, worn or damaged, impeller cavity or inlet plugged. 	<ol style="list-style-type: none"> Replace per servicing instructions.
Pump delivers insufficient capacity	<ol style="list-style-type: none"> Incorrect voltage. Excessive inflow or pump not properly sized for application. Discharge restricted. Check valve stuck closed or installed backwards. Shut-off valve closed. Impeller jammed, loose on shaft, worn or damaged, impeller cavity or inlet plugged. Pump may be airlocked. Pump running backwards. 	<ol style="list-style-type: none"> Make sure liquid level is at least equal to suggested turn-on point. Recheck all sizing calculations to determine proper pump size. Check discharge line for restrictions, including ice if line passes through or into cold areas.

PROBLEM	CAUSE	CORRECTION
Pump cycles too frequently or runs periodically when fixtures are not in use.	<ul style="list-style-type: none"> 6. Check valve not installed or leaking back into basin. 11. Fixtures are leaking. 15. Ground water entering basin. 	<ul style="list-style-type: none"> 6. Remove and examine check valve for proper installation and freedom of operation. 7. Open valve.
Pump shuts off and turns on independent of switch. (trips thermal overload protector). CAUTION ! Pump may start unexpectedly. Disconnect power supply.	<ul style="list-style-type: none"> 1. Improper wiring or power supply. 4. Discharge head less than minimum. 8. Impeller jammed or rubbing. 12. Excessive water temperature (internal protection only). 	<ul style="list-style-type: none"> 8. Check impeller for freedom of operation, security and condition. Clean impeller cavity and inlet of any obstruction. 9. Loosen union slightly to allow trapped air to escape. Verify that turn-off level of switch is set so that impeller cavity is always flooded. Clean vent hole.
Pump operates noisily or vibrates excessively.	<ul style="list-style-type: none"> 2c. Worn bearings, motor shaft bent. 8. Debris in impeller cavity or broken impeller. 10. Pump running backwards. 13. Piping attachments to building structure too rigid or too loose. 	<ul style="list-style-type: none"> 10. Check rotation. If power supply is three phase, reverse any two of three power supply leads to ensure proper impeller rotation. 11. Repair fixtures as required to eliminate leakage. 12. Check pump temperature limits & fluid temperature. 13. Replace portion of discharge pipe with flexible connector. 14. Turn to automatic position. 15. Check for leaks around basin inlet and outlets.

SECTION: F REPLACEMENT PARTS

F-1 ORDERING REPLACEMENT PARTS:

When ordering replacement parts, **ALWAYS** furnish the following information:

1. Pump serial number and date code. (F-4)
2. Pump model number. (F-3)
3. Pump part number. (F-2)
4. Part description.
5. Item part number.
6. Quantity required.
7. Shipping instructions.
8. Billing Instructions.

10/2/97
KJB

BARNES [®]			
HP	VOLTS	PH	HZ
	460	3	60
RPM	AMPS	CODE	
	5.8	G	
MODEL NO. 3 SE 1544 DS			
SERIAL NO. C546199-1095			
PART NO. 084930			
IMPELLER DIA. 6.00			

BARNES PUMPS, INC.
Mansfield, Ohio
084916

WARNING
1. TO MINIMIZE RISK OF ELECTRICAL SHOCK, PUMP MUST BE PROPERLY GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ALL APPLICABLE LOCAL CODES AND ORDINANCES.
2. TO REDUCE RISK OF ELECTRIC SHOCK, DISCONNECT THE PUMP FROM THE POWER SOURCE BEFORE HANDLING OR SERVICING.
3. KEEP CLEAR OF SUCTION AND DISCHARGE OPENINGS AT ALL TIMES WHEN POWER IS CONNECTED.
4. MOTOR HOUSING WILL CONTAIN HOT OIL UNDER PRESSURE IF MOTOR IS HOT. ALLOW MOTOR TO COOL BEFORE OPENING.
5. DO NOT USE THIS PUMP TO PUMP FLAMMABLE LIQUIDS.
6. THIS PUMP IS NOT TO BE INSTALLED IN LOCATIONS CLASSIFIED AS HAZARDOUS IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND/IN PA TO THIS PUMP IS NOT APPROVED FOR USE IN SWIMMING POOLS, RECREATIONAL WATER INSTALLATIONS, DECORATIVE FOUNTAINS, OR ANY INSTALLATION WHERE HUMAN CONTACT WITH THE PUMPED FLUID IS COMMON WHILE THE PUMP IS RUNNING.

F-2 PART NUMBER:

The part number consist of a six (6) digit number, which appears in the catalog. A one or two letter suffix may follow this number to designate the design configuration. This number is used for ordering and obtaining information.

F-3 MODEL NUMBER:

This designation consist of numbers and letters which represents the discharge size, series horsepower, motor phase and voltage, speed and pump design. This number is used for ordering and obtaining information.

F-4 SERIAL NUMBER:

The Serial Number consist of a ten digit number, which is specific to each pump. The first six digits are the pumps individual identity and the last four digits are the date the units was built. Example: 0056750490; 005675=Identity Number, 0490=Date Code (April of 1990).

Pump #1

SECTION: F REPLACEMENT PARTS

F-1 ORDERING REPLACEMENT PARTS:

When ordering replacement parts, **ALWAYS** furnish the following information:

1. Pump serial number and date code. (F-4)
2. Pump model number. (F-3)
3. Pump part number. (F-2)
4. Part description.
5. Item part number.
6. Quantity required.
7. Shipping instructions.
8. Billing Instructions.

BARNESTM

HP	VOLTS	PH.	HZ.
RPM	AMPS	CODE	
MODEL NO.			
SERIAL NO.			
PART NO.			
IMPELLER DIA.			

BARNES PUMPS, INC.
Mansfield, Ohio

08-916

WARNING

1. TO MINIMIZE RISK OF ELECTRICAL SHOCK, PUMP MUST BE PROPERLY GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ALL APPLICABLE LOCAL CODES AND ORDINANCES. 2. TO REDUCE RISK OF ELECTRICAL SHOCK, DISCONNECT THE PUMP FROM THE POWER SOURCE BEFORE HANDLING OR SERVICING. 3. KEEP CLEAR OF SUCTION AND DISCHARGE OPENINGS AT ALL TIMES WHEN POWER IS CONNECTED. 4. MOTOR HOUSING WILL CONTAIN HOT OIL UNDER PRESSURE IF MOTOR IS HOT. ALLOW MOTOR TO COOL BEFORE OPENING. 5. DO NOT USE THIS PUMP TO PUMP FLAMMABLE LIQUIDS. 6. THIS PUMP IS NOT TO BE INSTALLED IN LOCATIONS CLASSIFIED AS HAZARDOUS, IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. 7. THIS PUMP IS NOT TO BE USED TO PUMP WATER. 8. WATER INSTALLATION IS PROHIBITED. 9. WHERE HUMAN CONTACT WITH THE PUMPED FLUID IS COMMON, THE PUMP IS NOT TO BE USED.

F-2 PART NUMBER:

The part number consist of a six (6) digit number, which appears in the catalog. A one or two letter suffix may follow this number to designate the design configuration. This number is used for ordering and obtaining information.

F-3 MODEL NUMBER:

This designation consist of numbers and letters which represents the discharge size, series horsepower, motor phase and voltage, speed and pump design. This number is used for ordering and obtaining information.

F-4 SERIAL NUMBER:

The Serial Number consist of a ten digit number, which is specific to each pump. The first six digits are the pumps individual identity and the last four digits are the date the units was built. Example: 0056750490; 005675=Identity Number, 0490=Date Code (April of 1990).

Pump #2

C

C

C

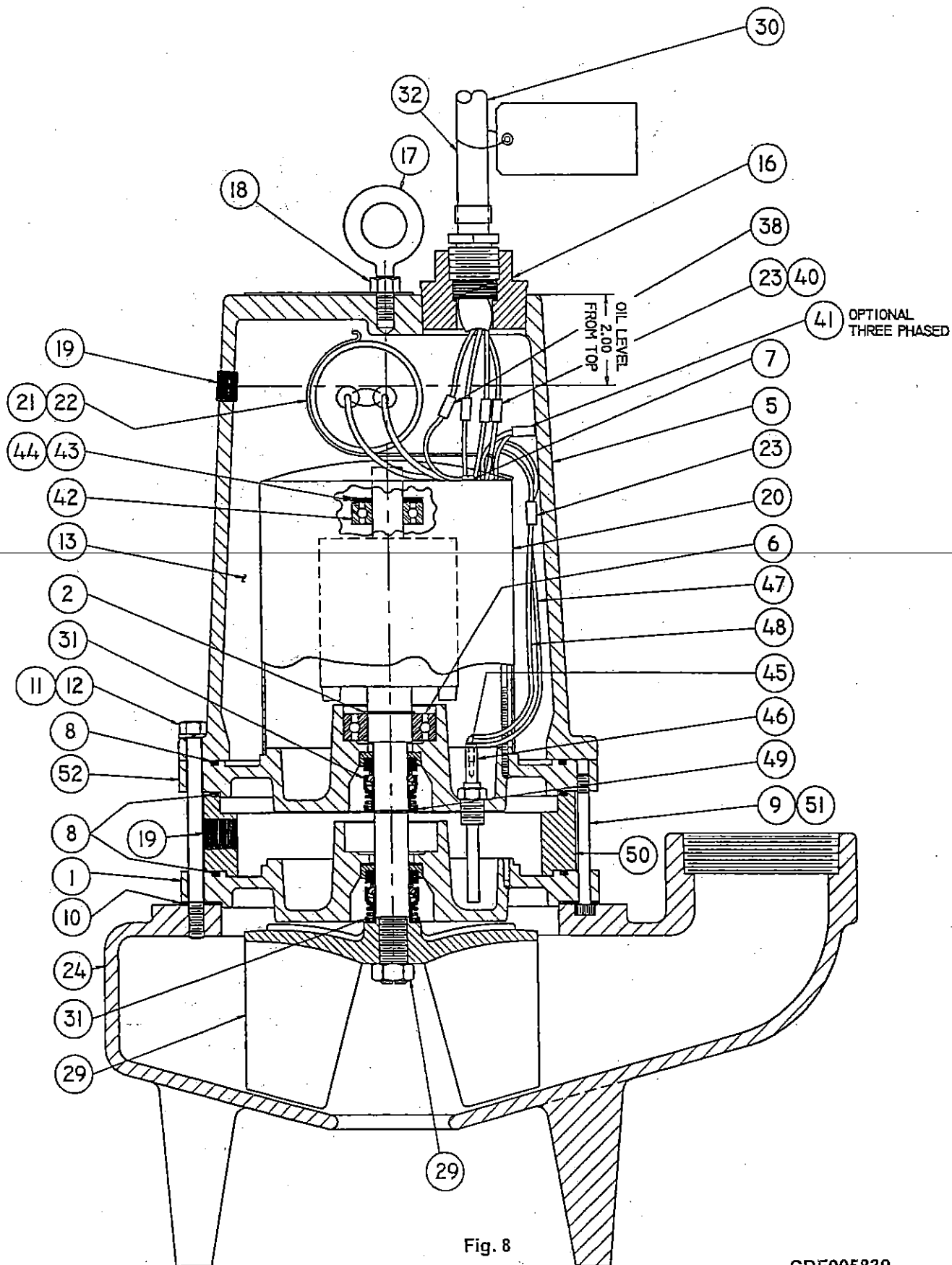


Fig. 8

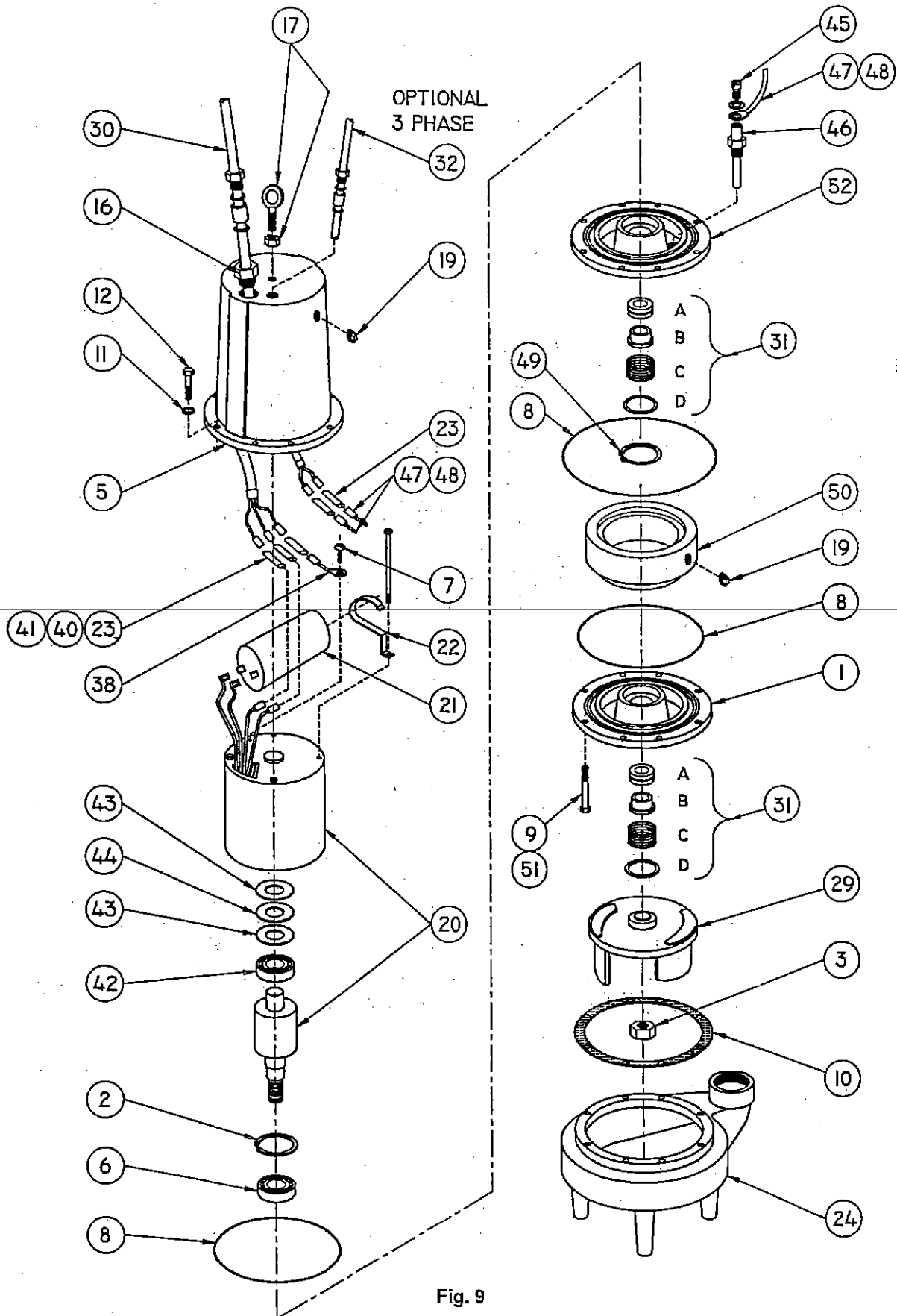


Fig. 9

CDF005840

PARTS KITS

Seal Repair Kit.....P/N-085475 (+) 8,10, 31.
 Overhaul Kit.....P/N-085445 (♦) 2,3,6,8,10,19,31,41,42.
 Seal Tool Kit.....P/N-085443
 Pressure Gauge Kit...P/N-085343

PARTS LIST

ITEM	QTY.	DESCRIPTION	PART NO.
1	1	Seal Plate	084343
2	1	♦ Retaining Ring	061143
3	1	♦ Nut 5/8-18 Stainless	038132
5	1	Motor Housing, with Moisture and/or Temp. Sensors.	084550HA
		Motor Housing No Sensor	084550
6	1	♦ Bearing	039734
7	1	Screw #8-32 x 3/8" lg stainless	016660
8	3	+♦ Square Ring	027269
9	2	Soc. Hd Cap Screw 1/4-20 x 1-1/4" lg stainless	084948
10	1	+♦ Gasket	027344
11	4	Lockwasher 5/16 stainless	026322
12	4	Cap Screw 5/16-18 x 4-1/2" lg stainless	064114
13	1Gal. 1.2 qts.	Oil (Motor Housing) (Seal Chamber)	029034
16	1	Hex Hd. Plug	084534
17	1	Eye Bolt & Nut 3/8-16 x 1" Lg Stainless	085666
19	2	♦ Pipe Plug 1/8 NPT	014270
20	1	Motor 3SE1524DS,2024	084382MB
		3SE1594DS,1544,2094,2044	084383MB
		3SE1554DS,2054	092859
21	1	Capacitor (single phase) 370V, 45MFD	085348
22	1	Capacitor Bracket (single phase)	039860
23	3	Terminal Connector (single phase)	079318
	4	Terminal Connector (three phase)	079318
	4	Terminal Connector (sensors)	079318
24	1	Volute	084399
29	1	Impeller, Cast Iron 7.00 Dia.	084439
		6.88 Dia.	084439TA
		6.75 Dia.	084439TB
		6.62 Dia.	084439TC
		6.50 Dia. (STD. for 2HP)	084439TD
		6.38 Dia.	084439TE
		6.25 Dia.	084439TF
		6.12 Dia.	084439TG
		6.00 Dia. (STD. for 1.5HP)	084439TH
		5.88 Dia.	084439TJ
		5.75 Dia.	084439TK
		5.62 Dia.	084439TL
		5.50 Dia.	084439TM
		5.38 Dia.	084439TN
		5.25 Dia.	084439TP
		5.12 Dia.	084439TQ
		5.00 Dia.	084439TR
		4.88 Dia.	084439TS
		4.75 Dia.	084439TT
		4.62 Dia.	084439TU
		4.50 Dia.	084439TV
30	1	Power Cable Set	See Table 2
30a	1	Cable	(Not Sold Separately)
30b	1	Gland Nut	51447

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30c	2	Friction Ring	(single phase)	066071
		Friction Ring	(three phase)	051450
30d	1	Grommet	(single phase)	066072
		Grommet	(three phase)	051452
31	2	+♦ Shaft Seal, Inner	Carbon/Ceramic/Buna-N (STD)	067562
			Tungsten/Tungsten/Buna-N	067562SB
			Silicon/Silicon/Buna-N	067562SD
			Carbon/Ceramic/Viton	067562SF
			Tungsten/Tungsten/Viton	067562SH
			Silicon/Silicon/Viton	067562SK
		Shaft Seal, Outer	Carbon/Ceramic/Buna-N (STD)	067562
			Tungsten/Tungsten/Buna-N	067562SB
			Silicon/Silicon/Buna-N	067562SD
			Carbon/Ceramic/Viton	067562SF
			Tungsten/Tungsten/Viton	067562SH
			Silicon/Silicon/Viton	067562SK
32	1	Control Cable Set		See Table 2
32a	1	Cable	(Not Sold Separately)	
32b	1	Gland Nut		051448
32c	2	Friction Ring		021531
32d	1	Grommet		066871
38	1	Wire Assembly		085073-WE
40	3	Terminal Connector	(Three Phase 200-230V)	071363
	7	Terminal Connector	(Three Phase 460 & 575V)	071363
	3	Terminal Connector	(Three Phase 460 & 575V)	026880
41	1	♦ Wire Connector	(Three Phase)	019212
42	1	♦ Bearing		017414
43	2	Belleville Washer		085282
44	1	Spacer		085283
45	2	Screw	6-32 x 3/8" lg zinc plt	038156
46	2	Moisture Sensor		071767
47	1	Wire Assembly		084957WT
48	1	Wire Assembly		084958WT
49	1	Retaining Ring		018370
50	1	Spacer		084440
51	2	Soc. Hd. Cap Screw	1/4-20 x 3" lg Stainless	067519
52	1	Seal Plate	(for moisture sensors)	084429
53	2	Plug	Replaces Item #46 for no sensor	003217

TABLE 2 - POWER & SENSOR CABLE SETS				
MODELS/ LENGTH	ITEM #30 1 Phase	ITEM #30 3 Phase	ITEM #32 Moist/Temp Sensor	ITEM #32 Temp Sensor
15 FT	085399	085092	079031	071769
20 FT	085399XA	085092XA	079031XA	071769XA
25 FT (STD)	085399XB	085092XB	079031XB	071769XB
30 FT	085399XC	085092XC	079031XC	071769XC
35 FT	085399XD	085092XD	079031XD	071769XD
40 FT	085399XE	085092XE	079031XE	071769XE
50 FT	085399XF	085092XF	079031XF	071769XF
60 FT	085399XG	085092XG	079031XG	071769XG
70 FT	085399XH	085092XH	079031XH	071769XH
80 FT	085399XJ	085092XJ	079031XJ	071769XJ
90 FT	085399XK	085092XK	079031XK	071769XK
100 FT	085399XL	085092XL	079031XL	071769XL
150 FT	085399XS	085092XS	079031XS	071769XS
200 FT	085399XY	085092XY	079031XY	071769XY

* Included with item number 30.

‡ Included with item number 32.

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IMPORTANT ! WARRANTY REGISTRATION

Your pump is covered by the enclosed Warranty. This warranty is ONLY effective provided the warranty registration is completed and returned to the Barnes® Pumps, Inc. service department.

IMPORTANT! If you have a claim under the provision of the warranty, contact your local Barnes Pumps, Inc. Distributor.

RETURNED GOODS POLICY

**RETURN OF MERCHANDISE REQUIRES A "RETURNED GOODS AUTHORIZATION".
CALL THE FACTORY SERVICE MANAGER, (513) 773-2442 FOR RGA NUMBER.**

RETURN OF EQUIPMENT: No equipment shall be returned to us without first obtaining a written Returned Goods Authorization and shipping instructions from us. The returner must prepay the charges in full for transportation to our factory. Credit allowed for new, undamaged equipment of current standard design will be 80% of the invoiced price or current billing price, whichever is less. Equipment which has been used, however slight, will not be accepted.

Authorization will not be given for return of equipment,

- (1) which would, in our opinion, result in an excess in the amount of stock we normally carry,
- (2) not invoiced within the last 12 months, or
- (3) which is non-standard and manufactured specifically to a buyer's specifications. For non-standard equipment not of our manufacture, the only credit allowed will be such credit as may be allowed by the manufacturer of such equipment.

Equipment must be returned within 30 days of the issuance of the Returned Goods Authorization. No item with a net value of less than \$35.00 will be authorized for return. Unauthorized returns may be refused and/or returned freight collect.

BARNES®

Limited Warranty

We warrant to our immediate customer and to the ultimate consumer that products of our manufacture will be free of defects in material and workmanship under normal use and service for the following time periods, when installed and maintained in accordance with our instructions.

Pump Products: One (1) year from date of installation or (24) twenty-four months from date of shipment, whichever occurs first. **Cleaning Products:** Twelve (12) months from date of installation or eighteen (18) months from date of shipment, whichever occurs first. As used herein, "the ultimate consumer" is defined as the purchaser who first uses the product after its initial installation or, in the case of product designed for non permanent installation, the first owner who used the product. It is the purchaser's or any sub-vendee's obligation to make known to the ultimate consumer the terms and conditions of this warranty. This warranty gives you specific legal rights, and there may also be other rights which vary from state to state. In the event the product is covered by the Federal Consumer Product Warranties Law (1) the duration of any implied warranties associated with the product by virtue of said law is limited to the same duration as stated herein, (2) this warranty is a LIMITED WARRANTY, and (3) no claims of any nature whatsoever shall be made against us, until the ultimate consumer, his successor, or assigns, notifies us in writing of the defect, and delivers the product and/or defective part(s) freight prepaid to our factory or nearest authorized service station. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply. **THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF ANY AND ALL WARRANTIES WITH RESPECT TO ANY PRODUCT SHALL BE TO REPLACE OR REPAIR AT OUR ELECTION, F.O.B. POINT OF MANUFACTURE OR AUTHORIZED REPAIR STATION, SUCH PRODUCTS AND/OR PARTS AS PROVEN DEFECTIVE. THERE SHALL BE NO FURTHER LIABILITY, WHETHER BASED ON WARRANTY, NEGLIGENCE OR OTHERWISE.** Unless expressly stated otherwise, guarantees in the nature of performance specifications furnished in addition to the foregoing material and workmanship warranties on a product manufactured by us, if any, are subject to laboratory tests corrected for field performance. Any additional guarantees, in the nature of performance specifications must be in writing and such writing must be signed by our authorized representative. Due to inaccuracies in field testing if a conflict arises between the results of field testing conducted by or for user, and laboratory tests corrected for field performance, the latter shall control. Components or accessories supplied by us but manufactured by others are warranted only to the extent of and by the terms and conditions of the original manufacturer's warranty. **RECOMMENDATIONS FOR SPECIAL APPLICATIONS OR THOSE RESULTING FROM SYSTEMS ANALYSES AND EVALUATIONS WE CONDUCT WILL BE BASED ON OUR BEST AVAILABLE EXPERIENCE AND PUBLISHED INDUSTRY INFORMATION. SUCH RECOMMENDATIONS DO NOT CONSTITUTE A WARRANTY OF SATISFACTORY PERFORMANCE AND NO SUCH WARRANTY IS GIVEN.**

This warranty shall not apply when damage is caused by (a) improper installation, (b) improper voltage (c) lightning (d) sand or other abrasive material (e) scale or corrosion build-up due to excessive chemical content. Any modification of the original equipment will also void the warranty. We will not be responsible for loss, damage or labor cost due to interruption of service caused by defective parts. Neither will we accept charges incurred by others without our prior written approval.

This warranty is void if our inspection reveals the product was used in a manner inconsistent with normal industry practice and/or our specific recommendations. The purchaser is responsible for communication of all necessary information regarding the application and use of the product. **UNDER NO CIRCUMSTANCES WILL WE BE RESPONSIBLE FOR ANY OTHER DIRECT OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, LOST INCOME, LABOR CHARGES, DELAYS IN PRODUCTION, IDLE PRODUCTION, WHICH DAMAGES ARE CAUSED BY ANY DEFECTS IN MATERIAL AND/OR WORKMANSHIP AND/OR DAMAGE OR DELAYS IN SHIPMENT. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

No rights extended under this warranty shall be assigned to any other person, whether by operation of law or otherwise, without our prior written approval.

BARNES PUMPS, INC. 420 Third Street, P.O. Box 603 • Piqua, Ohio 45356 • Ph: (513) 773-2442 • Fax: (513) 773-2238

CDF005844

**IMPORTANT !
WARRANTY REGISTRATION**

Your pump is covered by the enclosed Warranty. This warranty is ONLY effective provided the warranty registration is completed and returned to the Barnes Pumps, Inc. service department. Review the form below and fill in all information.

IMPORTANT! If you have a claim under the provision of the warranty, contact your local Barnes Pumps, Inc. Distributor.

FOLD HERE

**** IMPORTANT ! ****

THIS FORM MUST BE RETURNED TO VALIDATE THE WARRANTY

WARRANTY REGISTRATION

CUSTOMER'S NAME _____ DATE INSTALLED _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE # _____ FAX # _____

DEALER'S NAME _____

CITY _____ STATE _____ ZIP _____

PUMP MODEL NO. _____ SERIAL NO. _____ VOLTAGE _____

PART NO. _____

CDF005845

FOLD HERE AND TAPE, DO NOT STAPLE

PLACE
STAMP
HERE

**BARNES PUMPS, INC.
SERVICE DEPARTMENT
420 THIRD STREET
P.O. BOX 603
PIQUA, OHIO
45356-0603 - U.S.A.**

START-UP REPORT FOR SUBMERSIBLE PUMPS

This report is designed to insure the customer that customer service and a quality product are the number one priority with Barnes® Pumps, Inc. Please answer the following questions completely and as accurately as possible. Mail this form to:

BARNES PUMPS, INC.
PARTS & SERVICE DEPT.
420 THIRD ST.
P.O. BOX 603
PIQUA, OHIO 45356-0603 U.S.A.
ATTN: SERVICE MANAGER

REPORTS THAT ARE NOT RETURNED CAN DELAY OR VOID WARRANTY.

1) Pump Owner's Name _____
Address _____
Location of Installation _____
Person in Charge _____ Phone _____
Purchased From (Barnes Pumps' Representative/Distributor) _____

2) Barnes Pumps Model _____ Serial No. _____
Part Number _____
Voltage _____ Phase _____ Hertz _____ Horespower _____
Rotation: Direction of Impeller Rotation (Use C/W for clockwise, CC/W for counter-clockwise) _____
Method Used to Check Rotation (viewed from bottom) _____
Does Impeller Turn Freely By Hand _____ YES _____ NO _____

3) Condition Of Equipment _____ GOOD _____ FAIR _____ POOR
Condition Of Cable Jacket _____ GOOD _____ FAIR _____ POOR
Resistance of Cable Jacket _____ GOOD _____ FAIR _____ POOR
Resistance of Cable and Pump Motor (measured at pump control) _____
Red-Black _____ Ohms, Red-White _____ Ohms, White-Black _____ Ohms
Resistance Of Ground Circuit Between Control Panel and Outside of Pump _____ Ohms
MEG Ohms Check of Insulation:
Red to Ground _____ White to Ground _____ Black to Ground _____

4) Condition of Equipment At Start-Up: Dry _____ Wet _____ Muddy _____
Was Equipment Stored: _____ Length of Storage: _____
Describe Station Layout _____

5) Liquid Being Pumped _____
Debris In Bottom of Station? _____
Was Debris Removed In Your Presence? _____
Are Guide Rails Exactly Vertical? _____
Is BAF Stationary Installed Level? _____

6) Liquid Level Controls: Model _____
Is Control Installed Away From Turbulence _____
Operation Check:
Tip Lowest Float (stop float), All Pumps Should Remain Off.
Tip Second Float (and stop float), One Pump Comes On.
Tip Third Float (and stop float), Both Pumps On (alarm on simplex).
Tip Fourth Float (and stop float), High Level Alarm On (omit on simplex).

If not Barnes level controls, describe type of controls _____
Does liquid level ever drop below volute top? _____

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7) Barnes Pumps Control Panel Part No. _____

Number of Pumps Operated By Control Panel _____

NOTE: At no time should holes be made in top of control panel, unless proper sealing devices are utilized.

Control Panel Manufactured By Others: _____

Company Name _____

Model No. _____

Short Circuit Protection _____ Type _____

Number and Size of Short Circuit Device(s) _____ Amp Rating _____

Overload Type _____ Size _____ Amp Rating _____

Do Protective Devices Comply With Pump and Motor Amp Rating _____

Are All Connections Tight? _____

Is The Interior of The Panel Dry? _____

8) Electrical Readings:

Single Phase:

Voltage Supply at Panel Line Connection, Pump Off, L1, L2 _____

Voltage Supply at Panel Line Connection, Pump On, L1, L2 _____

Amperage: Load Connection, Pump On, L1 _____ L2 _____

Three Phase:

Voltage Supply at Panel Line Connection, Pump Off, L1-L2 _____ L2-L3 _____ L3-L1 _____

Voltage Supply at Panel Line Connection, Pump On, L1-L2 _____ L2-L3 _____ L3-L1 _____

Amperage, Load Connection, Pump On, L1 _____ L2 _____ L3 _____

9) Final Check:

Is Pump Seated On Discharge Properly? _____ Check for Leaks? _____

Does Check Valves Operate Properly? _____

Flow, Does Station Appear To Operate At Proper Rate _____ Pump Down Time _____

Noise Level: High _____ Medium _____ Low _____

Comments: _____

10) Equipment Difficulties During Start-Up: _____

11) Manuals:

Has Operator Received Pump Instructions and Parts Manual? _____

Has Operator Received Electrical Control Panel Diagram? _____

Has Operator Been Briefed On Warranty? _____

Address of Local Barnes Pumps Representative/Distributor _____

12) I Have Received The Above Information (Name of Operator) _____

Name of Company _____

Date _____

I Certify This Report To Be Accurate (Name of Start-Up Person) _____

(Employed By) _____

Date _____

Date and Time of Start-Up _____

Present At Start-Up:

() Engineer _____

() Operator _____

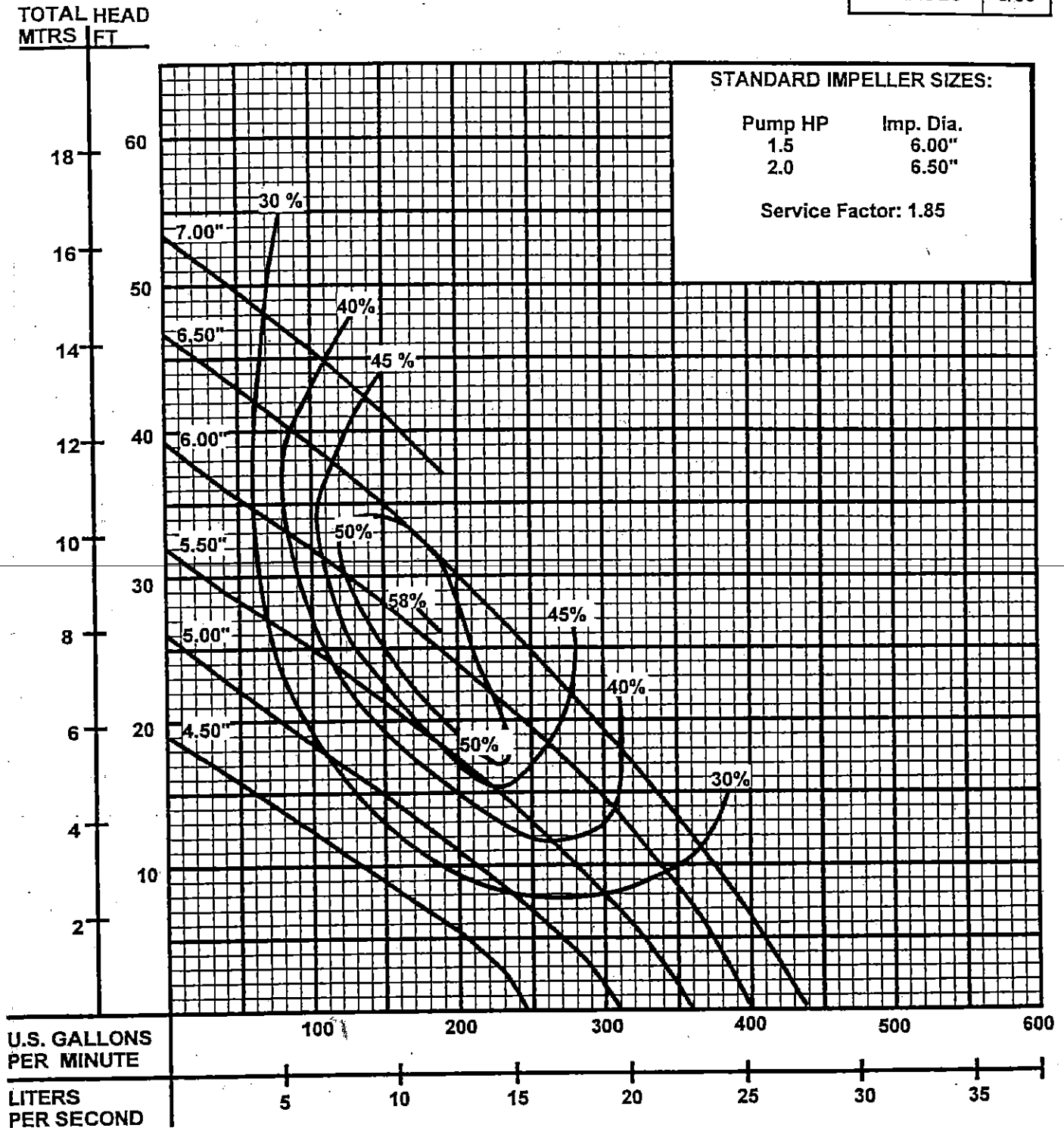
() Contractor _____

() Other _____

PERFORMANCE CURVE

Series: 3SE-DS, 1.5 & 2.0 HP, 1750RPM

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Testing is performed with water, specific gravity of 1.0 @ 68° F, other fluids may vary performance.

CRANE

PUMPS & SYSTEMS

Barnes Pumps, Inc.
Distributor Sales & Service Dept.
420 Third Street/P.O. Box 603
Piqua, Ohio 45356-0603
Ph: (513) 773-2442
Fax: (513) 773-2238

Barnes Pumps, Inc.
Bid-To-Spec & Project Sales
1485 Lexington Ave.
Mansfield, Ohio 44907-2674
Ph: (419) 774-1511
Fax: (419) 774-1530

CDF005849

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Submersible Wastewater
Pump Association
SWPA
MEMBER

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PUMPS & SYSTEMS

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